



PV Inverter

SUNNY BOY 2500TL Single Tracker

SUNNY BOY 3000TL Single Tracker

Installation Manual

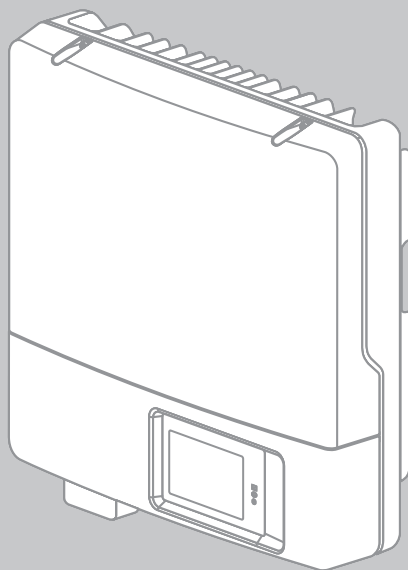


Table of Contents

1	Information on this Document.	7
1.1	Validity	7
1.2	Target Audience	7
1.3	Additional Information	7
1.4	Symbols Used	8
2	Safety	10
2.1	Intended Use.	10
2.2	Qualification of Skilled Persons	11
2.3	Safety Precautions.	12
3	Scope of Delivery.	14
4	Product Description	15
4.1	Sunny Boy.	15
4.2	Symbols on the Inverter.	16
4.3	Type Label	17
4.4	Display	19
4.5	Electronic Solar Switch	22
4.6	Communication.	23
4.7	Multi-Function Relay	23
4.8	Grid Management	24
4.9	Varistors	24
5	Mounting.	25
5.1	Safety	25
5.2	Selecting the Mounting Location.	25
5.3	Mounting the Inverter	27

6	Electrical Connection	30
6.1	Safety	30
6.2	Overview of the Connection Area	30
6.3	Connection to the Electricity Grid (AC)	32
6.3.1	Conditions for the AC Connection	32
6.3.2	Connecting the Inverter to the Electricity Grid (AC)	35
6.3.3	Additional Earthing of the Enclosure	38
6.4	Connecting the PV Array (DC)	38
6.4.1	Conditions for the DC connection	38
6.4.2	Assembling the DC Connectors	39
6.4.3	Opening the DC Connector	41
6.4.4	Connecting the PV Array (DC)	42
6.5	Setting the Country Standard and Display Language	46
6.5.1	Checking the Country Standard	48
6.5.2	Setting the Country Standard and Language using the Rotary Switch	51
6.6	Communication	52
6.6.1	Interface for RS485 Communication	52
6.6.2	Setting the <i>Bluetooth</i> NetID	53
6.6.3	Multi-Function Relay	53
7	Commissioning	54
7.1	Commissioning the Inverter	54
7.2	Display Messages during the Start Phase	55
7.3	Self-test in Accordance with ENEL Guideline (Only for Italy)	56
7.3.1	Starting the Self-Test	56
7.3.2	Test Sequence	57
7.3.3	Aborting the Self-Test	60
7.3.4	Restarting the Self-Test	60

8	Opening and Closing	61
8.1	Safety	61
8.2	Disconnecting the Inverter from Voltage Sources	62
8.3	Closing the Inverter	65
9	Maintenance and Cleaning	67
9.1	Cleaning the Inverter	67
9.2	Checking Heat Dissipation	67
9.3	Checking the Electronic Solar Switch for Wear	68
10	Slot for SD Card	69
11	Troubleshooting	70
11.1	LED Signals	70
11.2	Event Messages	71
11.3	Error Messages	72
11.4	DC Current after AC-side Disconnection	82
11.5	Checking the PV Array for Earth Faults	82
11.6	Checking the Function of the Varistors	84
12	Decommissioning	88
12.1	Disassembling the Inverter	88
12.2	Replacing the Enclosure Lid	88
12.3	Packing the Inverter	91
12.4	Storing the Inverter	91
12.5	Disposing of the Inverter	91
13	Technical Data	92
13.1	DC/AC	92
13.1.1	Sunny Boy 2500TL Single Tracker	92
13.1.2	Sunny Boy 3000TL Single Tracker	93
13.2	General Data	94

13.3 Protective Devices 95

13.4 Approvals 95

13.5 Climatic Conditions 96

13.6 Features 96

13.7 Electronic Solar Switch 96

13.8 Torques 96

13.9 Earthing Systems 97

13.10 Data Storage Capacity 97

14 Accessories 98

15 Contact 99

1 Information on this Document

1.1 Validity

This document is valid for the following device types:

- SB 2500TLST-21
- SB 3000TLST-21

1.2 Target Audience

This document is for skilled workers. Only skilled workers are allowed to perform the tasks set forth in this document (see Section 2.2 "Qualification of Skilled Persons" (page 11)).


1.3 Additional Information

Additional information is available at www.SMA.de/en.

Title	Document type
Miniature Circuit-breaker	Technical information
Measured Values, Operating Parameters, and Event Messages.	Technical description
Parameter Settings – SUNNY BOY 2500TL / 3000TL Single Tracker SUNNY BOY 3000TL / 3600TL / 4000TL / 5000TL	Technical description
SMA Bluetooth – SMA Bluetooth® Wireless Technology in Practice	Technical information
SMA Bluetooth® Wireless Technology	Technical description
Multi-functional relay and OptiTrac Global Peak	Technical description
Module Technology	Technical information
Capacitive Discharge Currents	Technical information


1.4 Symbols Used

The following types of safety precautions and general information appear in this document:




DANGER!

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.




WARNING!

WARNING indicates a safety precaution which, if not avoided, could result in death or serious injury.




CAUTION!

CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.



NOTICE!

NOTICE indicates a situation which, if not avoided, could result in property damage.



Information
Information provides tips that are valuable for effective installation and operation of the product.

☒ This symbol indicates the result of an action.

Nomenclature

The following nomenclature is used in this document:

Complete designation	Abbreviation in this document
Sunny Boy 2500TL Single Tracker/ Sunny Boy 3000TL Single Tracker	Inverter, product
Electronic Solar Switch	ESS
SMA Bluetooth® Wireless Technology	Bluetooth

Abbreviations

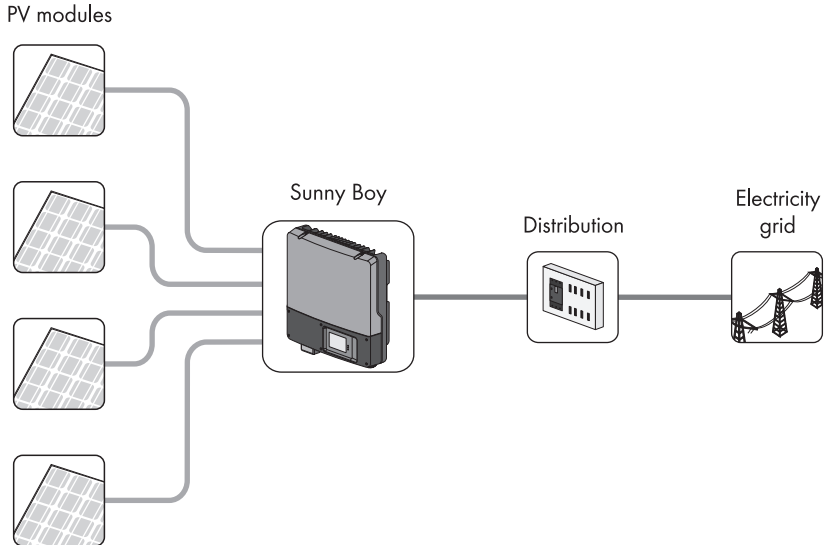
Abbreviation	Designation	Explanation
AC	Alternating Current	-
DC	Direct Current	-
EG	European Community	-
LED	Light-Emitting Diode	-
MPP	Maximum Power Point	-
NetID	Network Identification	Identification number for SMA <i>Bluetooth</i> network
MSL	Mean Sea Level	-
PE	Protective Earth	Protective conductor
PV	Photovoltaics	-
AF	Width Across Flats	The distance between two parallel flat surfaces ("flats") of a screw head.
VDE	Verband der Elektrotechnik Elektronik Informationstechnik e.V.	Association for Electrical, Electronic and Information Technologies

2 Safety

2.1 Intended Use

The Sunny Boy is a PV inverter, which converts the direct current of the PV array to grid-compliant alternating current and feeds it into the electricity grid.

Principle of a PV Plant with this Sunny Boy



The Sunny Boy is suitable for indoor and outdoor use.

The Sunny Boy may only be operated with PV arrays (PV modules and cabling) of protection class II. The PV modules used must be suitable for use with the Sunny Boy and must be released by the module manufacturer.

PV modules with large capacities to earth may only be used if their coupling capacity does not exceed 1.4 μF .

All components must remain within their operating ranges at all times.

For safety reasons, it is not permitted to modify the product or install components that are not explicitly recommended or distributed by SMA Solar Technology AG for this product.

Only use the Sunny Boy in accordance with the information provided in the enclosed documentation. Any other use can result in personal injury or property damage.

- Do not mount the inverter on flammable construction materials.
- Do not mount the inverter in areas where highly flammable materials are stored.
- Do not mount the inverter in a potentially explosive atmosphere.

The enclosed documentation is an integral part of this product.

- Read and adhere to the documentation.
- Keep the documentation in a convenient place for future reference.

2.2 Qualification of Skilled Persons

The tasks described in this document are intended for skilled persons only. Skilled persons must have the following qualifications:

- Knowledge of how an inverter works and is operated
- Training in how to deal with the dangers and risks associated with installing and using electrical devices and plants
- Training in the installation and commissioning of electrical devices and plants
- Knowledge of all applicable standards and guidelines
- Knowledge of and adherence to this document and all safety precautions

2.3 Safety Precautions

**DANGER!**

Danger to life due to high voltages in the inverter.

High voltages that can result in electric shocks are present in the conductive components of the inverter.

- Prior to performing any work on the inverter, disconnect the inverter on the AC and DC sides (see Section 8.2 "Disconnecting the Inverter from Voltage Sources" (page 62)).

**DANGER!**

Risk of burns due to electric arc

To prevent arcing when disconnecting cables in the PV array, the ESS and DC connectors must be removed from the inverter, or the external DC switch-disconnector must be switched off and the DC connectors must be removed from the inverter before performing any work on the PV array.

- Before starting work on the PV array, always disconnect the inverter from the AC and DC side (see Section 8.2 "Disconnecting the Inverter from Voltage Sources" (page 62)).
- Attach the enclosed warning label "Risk of burns from electric arc" so that it is clearly visible on the external AC disconnection device.

**WARNING!**

Risk of electric shock when pulling out the DC connectors under load.

If you disconnect the DC connectors from the inverter under load, an electric arc may occur, causing electric shock and burns.

- If the inverter is not equipped with an Electronic Solar Switch and the regulations in the country of installation require an external DC switch-disconnector, install an external DC switch-disconnector.
- Switch off the AC miniature circuit-breaker and disconnect the inverter on the DC side before pulling out the DC connectors.

**CAUTION!**

Risk of burns due to hot enclosure parts

Some parts of the enclosure can become hot during operation.

- Only touch the lower enclosure lid of the inverter during operation.

**NOTICE!****Water and dust intrusion can damage the inverter.**

If the inverter is not equipped with an ESS, the electronics in the inverter comply with degree of protection IP65 when closed. If the inverter is equipped with an ESS, the electronics in the inverter comply with degree of protection IP65 when closed with the ESS attached. The inverter is then protected against dust and water intrusion. The inverter's connection area complies with degree of protection IP54. It is protected against dust deposits in the interior and against splashes of water from all angles.

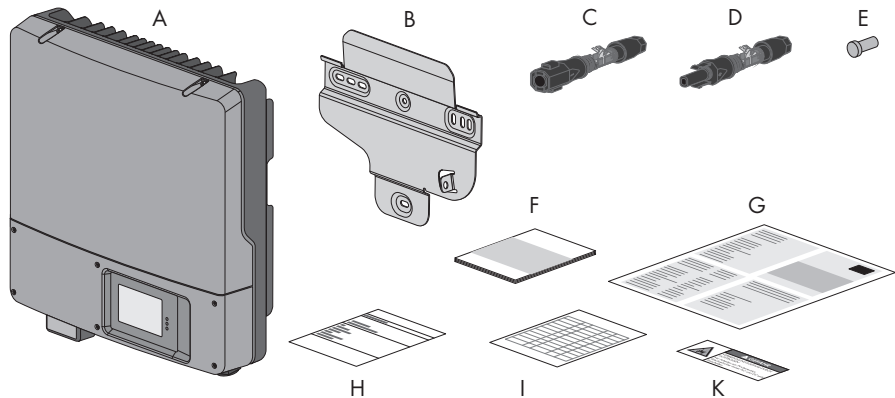
- If the ESS is not attached, the inverter must be protected against dust and water.
- Attach the ESS again after any work on the inverter.

**PV array earthing**

Comply with local regulations for the earthing of the modules and the PV array. SMA Solar Technology AG recommends connecting the array frame and other electrically conductive surfaces so that there is continuous conduction and earthing them in order to ensure maximum protection for property and persons.

3 Scope of Delivery

Check the delivery for completeness and any externally visible damage. Contact your dealer if the delivery is incomplete or you find any damage.

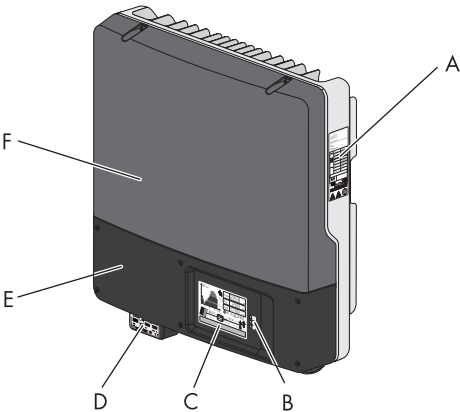


Object	Quantity	Description
A	1	Sunny Boy
B	1	Wall mounting bracket
C	2	Positive DC connector
D	2	Negative DC connector
E	4	Sealing plugs for the DC connectors
F	1	Installation manual
G	1	User manual
H	1	Document set with explanations and certificates
I	1	Supplementary sheet with inverter default settings
K	1	Warning label "Risk of burns from electric arc" for the disconnection device on the AC side.

4 Product Description

4.1 Sunny Boy







The Sunny Boy is a PV inverter, which converts the direct current of the PV array to grid-compliant alternating current and feeds it into the electricity grid.



Position	Designation
A	Type label
B	LEDs
C	Display
D	Electronic Solar Switch*
E	Lower enclosure lid
F	Upper enclosure lid

*optional

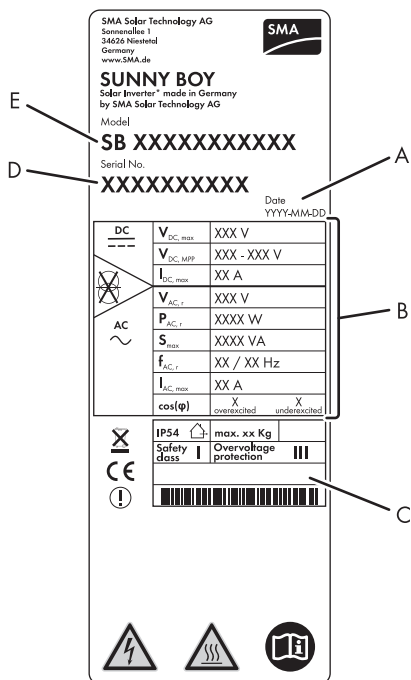
4.2 Symbols on the Inverter

Symbol	Designation	Explanation
	Inverter	This symbol defines the function of the green LED. The green LED indicates the operating state of the inverter.
	Read the documentation!	This symbol defines the function of the red LED which indicates a fault or disturbance. Read the manual to remedy the fault or disturbance.
	Bluetooth	This symbol defines the function of the blue LED. The blue LED indicates that communication via Bluetooth is activated.
	QR-Code ^{®*} for SMA bonus programme	For information on the SMA bonus programme, see www.SMA-Bonus.com .
	NOTICE, danger!	Observe the connection requirements for the second protective conductor in Section 6.3.1 "Conditions for the AC Connection" (page 32).
	Danger to life due to high voltages in the inverter	<p>The capacitors in the inverter may be charged with very high voltages.</p> <ul style="list-style-type: none"> Disconnect the inverter from voltage sources (see Section 8.2) and wait 5 minutes before opening the upper lid, in order to allow time for the capacitors to discharge.

* QR-Code is a registered trademark of DENSO WAVE INCORPORATED.

4.3 Type Label













The type label provides a unique identification of the inverter. The type label is on the right-hand side of the enclosure.




Position	Designation	Explanation
A	Date	Manufacturing date of the inverter (year-month-day)
B	Device-specific characteristics	-
C	Additional information	Field for additional information, e.g. country-specific standard information
D	Serial No.	Inverter serial number
E	Model	Device type

The information on the type label is intended to help you use the inverter safely and receive better customer support from the SMA Service Line. The type label must be permanently attached to the inverter.

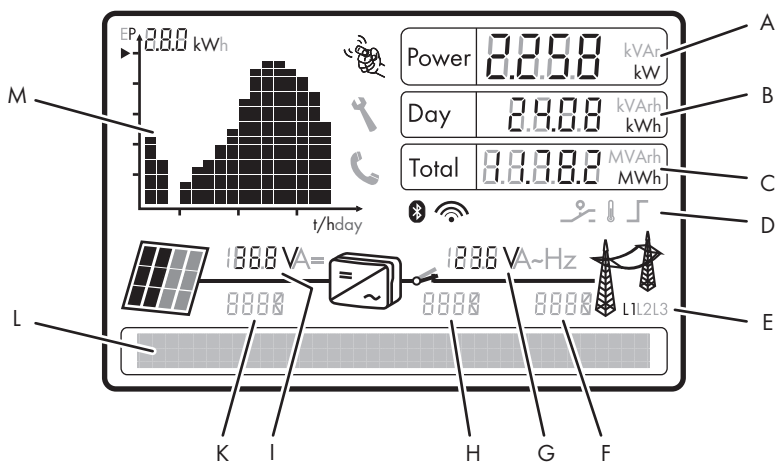
Symbols on the Type Label

Symbol	Designation	Explanation
	Danger to life due to high voltages.	The inverter operates at high voltages. All work on the inverter must be carried out by skilled workers only.
	Risk of burns from hot surfaces	The inverter can become hot during operation. Avoid contact during operation. Allow the inverter to cool down sufficiently before carrying out any work. Wear personal protective equipment such as safety gloves.
	Read the documentation	Observe all documentation that is supplied with the inverter.
	Without transformer	The inverter is transformerless.
	DC	Direct current
	AC	Alternating current
IP54	Degree of protection IP54	The inverter is protected against dust deposits in the interior and against splashes of water from all angles.
	Outdoor	The inverter is suitable for outdoor installation.
	Proper disposal	The inverter must not be disposed of together with the household waste.
	CE marking	The inverter complies with the requirements of the applicable EC directives.
	Device class label	The product is equipped with a wireless component that complies with the harmonised standards.
	RAL quality mark for solar products	The inverter complies with the requirements of the German Institute for Quality Assurance and Labelling.
	Certified safety	The inverter complies with the requirements of the European Equipment and Product Safety Act.

Symbol	Designation	Explanation
 N23114	Australian mark of conformity	The inverter complies with the requirements of the applicable Australian guidelines.

4.4 Display










The display shows the current operating data of the inverter (e.g. status, power, input voltage) as well as faults and disturbances.






Position	Designation	Explanation
A	Power	Displays the current power
B	Day	Displays the daily energy
C	Total	Displays the total amount of energy fed in until now
D	Active functions	The symbols indicate which communication or power regulation functions are enabled.
E	Line conductor assignment	Shows assignment of the inverter to a line conductor. It is also used for external power limitation.
F	Electricity grid event number	Event number of a disturbance in the electricity grid
G	Output voltage/output current	The display alternately shows the output voltage and the output current of the inverter.
H	Inverter event number	Event number of a device disturbance
I	Input voltage/input current	The display alternately shows the input voltage and the input current of the inverter.
K	PV array event number	Event number of a disturbance in the PV array
L	Text line	The text line shows event messages or instructions.

Position	Designation	Explanation
M	Power and yield curve	The diagram shows the changes in power over the last 16 feed-in hours or the energy yields over the last 16 days. Tap the display once to switch between views.

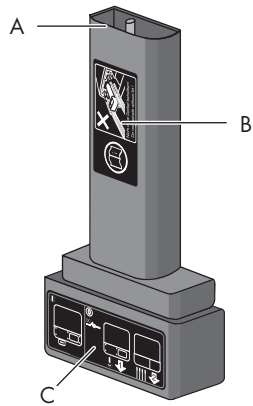
Symbols on the Display

Symbol	Designation	Explanation
	Tap symbol	You can operate the display by tapping it: <ul style="list-style-type: none"> Single tap: the backlight switches on or the display scrolls one message further. Double tap: the display shows, in succession, the firmware version, the serial number or description of the inverter, the <i>Bluetooth</i> NetID, the set country standard and the display language.
	Telephone receiver	Device disturbance present. Contact the SMA Service Line.
	Spanner	Signifies a disturbance that can be resolved on-site.
	<i>Bluetooth</i>	<i>Bluetooth</i> communication is enabled.
	<i>Bluetooth</i> connection	<i>Bluetooth</i> connection to other devices is active.
	Multi-function relay	The multi-function relay is active.
	Temperature symbol	The power of the inverter is limited due to excessive temperature.
	Power limitation	The external active power limitation via the Power Reducer Box is active.
	PV array	–

Symbol	Designation	Explanation
	Inverter	-
	Grid relay	If the grid relay is closed, the inverter feeds power into the grid. If the grid relay is open, the inverter is disconnected from the electricity grid.
	Electricity grid	-

4.5 Electronic Solar Switch

The ESS is an optional DC load disconnect unit. The ESS prevents electric arcs from forming when you remove the DC connector.



Position	Designation	Explanation
A	Plug	-
B	Safety precautions sticker	<ul style="list-style-type: none">• Never operate the inverter without the lower enclosure lid in place.• Observe all documentation that accompanies the inverter.
C	ESS sticker	<ul style="list-style-type: none">• ❶ If the ESS is plugged in, the DC circuit remains closed.• ❷ To interrupt the DC circuit, you must perform steps 1 and 2.• ❶ Remove the ESS.• ❷ Remove all DC connectors.

When plugged in, the ESS forms a conductive path between the PV array and the inverter. Removing the ESS interrupts the electric circuit and allows you to safely disconnect the DC connectors from the inverter.

4.6 Communication

The inverter is equipped with a *Bluetooth* interface as standard. A multi-function relay and an additional communication interface (e.g. RS485) can be retrofitted. The inverter can communicate with special SMA communication products (e.g. data logger, software) or other inverters via the communication interfaces. You can only adjust the inverter's operating parameters using SMA communication products.

If you order an inverter with an additional communication interface, the communication interface is built in upon delivery.

If you communicate via *Bluetooth*, you can protect the inverter with a plant password for the user and a plant password for the installer. All inverters are delivered with the same factory-installed passwords. You must change plant passwords using a communication product in order to protect the PV plant from unauthorised access.

If you do not communicate via *Bluetooth*, deactivate *Bluetooth* communication (see 6.6.2 "Setting the Bluetooth NetID" (page 53)). This protects your PV plant from unauthorised access.



Various parameter displays

Depending on the type of communication, RS485 or *Bluetooth*, the parameters and messages are displayed differently on the communication products.

Example: parameter display for the country standard

- For communication with RS485: "CntrySet" parameter
- For communication with *Bluetooth*: "Set country standard" parameter

4.7 Multi-Function Relay

The inverter may be equipped with a multi-function relay. The multi-function relay is an interface for error messages or for controlling loads. Disturbances can be transmitted to a disturbance sensor. For this purpose, the multi-function relay switches the disturbance sensor on and off. The multi-function relay can control a load via a contactor.

For this purpose, the inverter determines when the load is switched on and off, depending on the operating parameters and measured values. You can configure the multi-function relay for various operating modes (see Technical Description "Multi-functional relay and OptiTrac Global Peak" available at www.SMA.de/en).

4.8 Grid Management

The inverter is equipped with grid management functions.

You can activate and configure the functions via operating parameters depending on the requirements of the network operator (e.g. provision of reactive power, active power limitation).

For detailed information on the parameters of these functions, see the Technical Descriptions "Measured Values, Operating Parameters and Event Messages" and "Parameter Settings – SUNNY BOY 2500TL / 3000TL Single Tracker SUNNY BOY 3000TL / 3600TL / 4000TL / 5000TL" at www.SMA.de/en in the "Technical Description" category for the respective inverter.

4.9 Varistors

Varistors are voltage-dependent resistors that protect the inverter against overvoltage. The inverter is equipped with 2 thermally monitored varistors.

The function of the varistors can diminish with age or repeated strain as a result of overvoltage. This can cause varistor wear. The inverter detects if one of the varistors is defective and indicates a disturbance.

The varistors are specially manufactured for use in the inverter and are not commercially available. You must order new varistors directly from SMA Solar Technology AG.

5 Mounting

5.1 Safety

**DANGER!**

Danger to life due to fire or explosions.

Despite careful construction, electrical devices can cause fires.

- Do not mount the inverter on flammable construction materials.
- Do not mount the inverter in areas where highly flammable materials are stored.
- Do not mount the inverter in a potentially explosive atmosphere.

**CAUTION!**

Risk of burns due to hot enclosure parts

- Mount the inverter in such a way that it cannot be touched inadvertently during operation.

**CAUTION!**

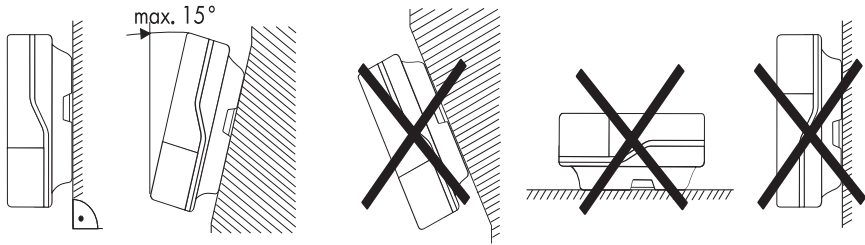
Risk of injury due to the heavy weight of the inverter.

- For mounting, remember that the inverter weighs 23 kg.

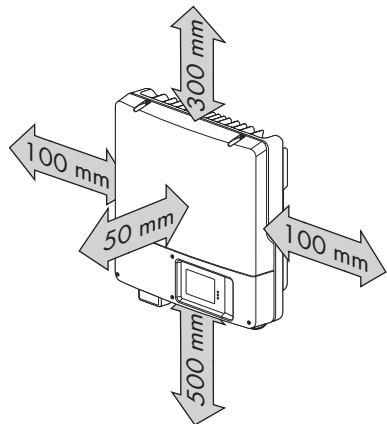
5.2 Selecting the Mounting Location

Consider the following requirements when selecting the mounting location:

- The mounting location must be inaccessible to children.
- The mounting method and location must be suitable for the inverter's weight and dimensions (see Section 13 "Technical Data" (page 92)).
- Mount on a solid surface.
- The mounting location must be clear and safely accessible at all times without the use of additional aids such as scaffolding or lifting platforms. Non-fulfillment of these criteria may restrict the execution of service assignments.



- Mount vertically or tilted backwards by max. 15°.
- The connection area must point downwards.
- Never mount the device with a forward tilt.
- Never mount the device with a sideways tilt.
- Do not mount horizontally.
- Mount at eye level so that operating states can be read at all times.
- The ambient temperature should be below 40°C to ensure optimum operation.
- Do not expose the inverter to direct solar irradiation as this can cause excessive heating and thus power reduction.
- To avoid audible vibrations in living areas, do not mount the unit on plasterboard walls or similar. When in use, the inverter emits noises which may be perceived as a nuisance in a living area.
- Observe the recommended minimum clearances to the walls as well as to other inverters and objects as shown in the diagram. That ensures sufficient heat dissipation and gives you enough space to unplug the ESS.
- If multiple inverters are mounted in areas with high ambient temperatures, increase the clearances between the inverters and ensure an adequate fresh-air supply. This prevents a reduction in inverter power as a result of high temperatures (details on temperature derating can be found in the Technical Information "Temperature Derating" at www.SMA.de/en). A fan is available as an accessory for connection to the inverter (see Section 14 "Accessories" (page 98)).



5.3 Mounting the Inverter

Supplementary mounting material (not included in the scope of delivery):

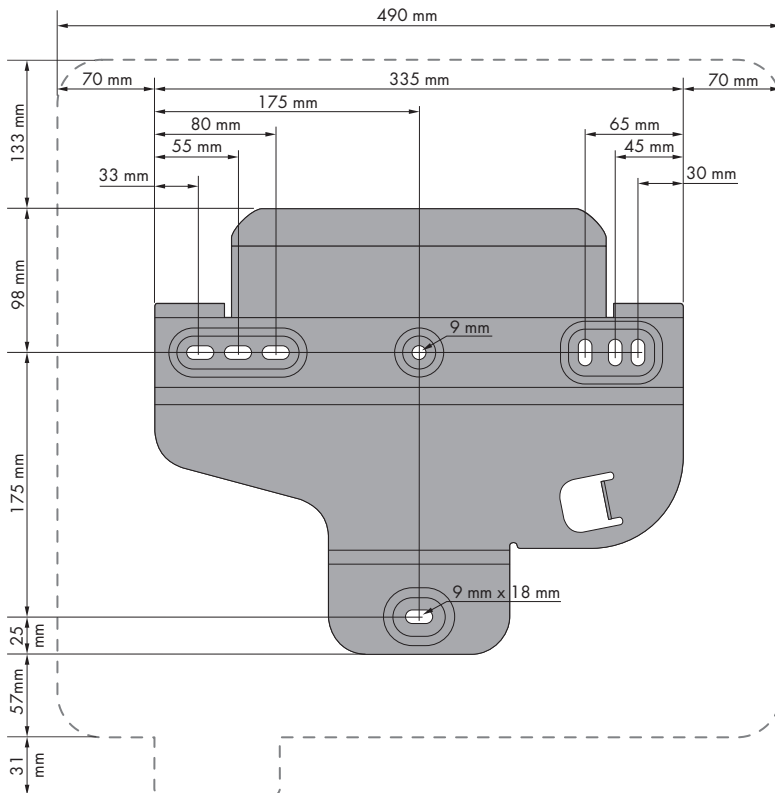
- 3 screws (diameter: at least 6 mm)
- 3 wall plugs
- 3 washers (external diameter: at least 18 mm)

1. Use the wall mounting bracket as a drilling template and mark the positions of the drill holes.

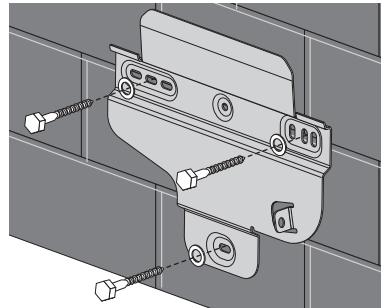


Number of drill holes to use

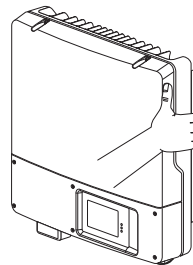
- When mounting onto the wall, use at least 2 of the horizontal holes and the lower centre hole.
- Use the two holes in the centre when mounting the device to a pillar.



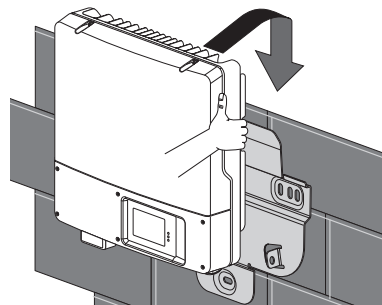
2. Drill the holes.
3. Attach the wall mounting bracket using appropriate screws (diameter min. 6 mm) and washers (outer diameter min. 18 mm).



4. Carry the inverter using the recessed grips on the sides.



5. Hook the inverter into the wall mounting bracket from above.



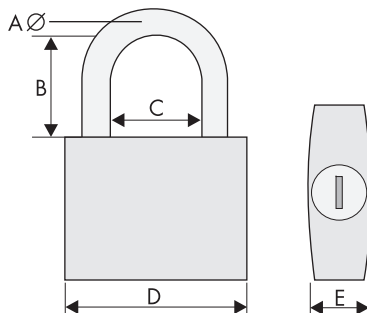
6. Check both sides of the inverter to make sure it is correctly in place.

Optional Theft Protection

To protect the inverter from theft, you can lock it to the wall mounting bracket with a padlock.

The padlock must meet the following requirements:

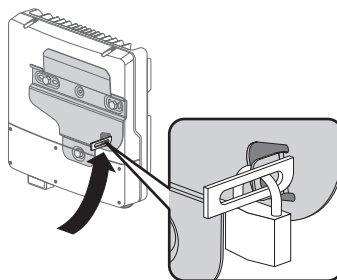
- Size:
 - A: 6 mm ... 8 mm diameter
 - B: 23 mm ... 29 mm
 - C: 23 mm ... 28 mm
 - D: 39 mm ... 50 mm
 - E: 13 mm ... 18 mm
- Stainless
- Hardened shackle
- Secured lock cylinder



Outdoor Mounting

Always use a lock suitable for outdoor mounting. Check the padlock on a regular basis to ensure it is working properly.

- Route the lock shackle from the centre of the device outwards through the metal clip on the wall mounting bracket and the slot on the inverter and close the lock.



Storage of the key

Keep the key in a safe place in case it is needed for service purposes.

6 Electrical Connection

6.1 Safety



NOTICE!

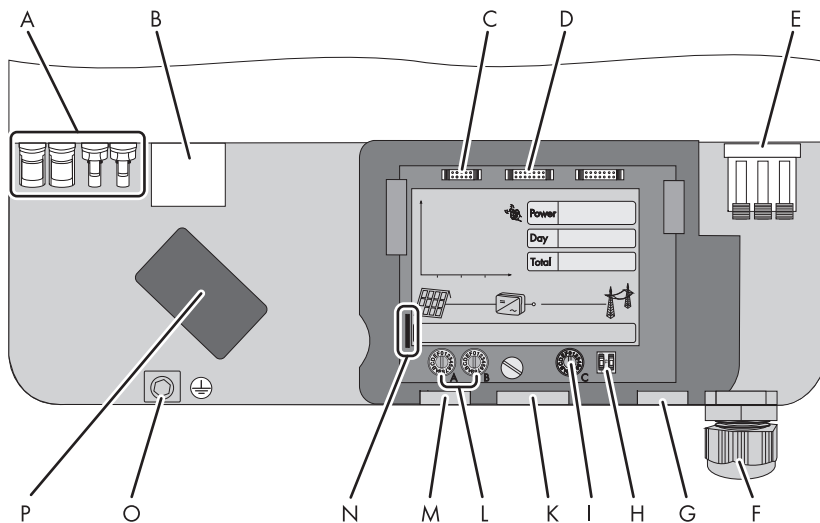
Electrostatic discharge can damage the inverter

Internal components of the inverter can be irreparably damaged by electrostatic discharge.

- Earth yourself before touching any components.

6.2 Overview of the Connection Area

The following figure shows the inverter's connection area with the lower enclosure lid open.



Position	Description
A	DC connectors for connecting the strings
B	Jack for connecting the ESS*
C	Plug for connecting the optional multi-function relay or additional fan kit
D	Plug for optional communication via RS485
E	Terminal for the AC cable
F	Cable gland (12 mm ... 21 mm) for routing the AC cable

Position	Description
G	Enclosure opening for connecting the optional multi-function relay or additional fan kit or optional communication via RS485
H	Switch for temporarily changing the display language to English (for service purposes)
I	Rotary switch for configuring <i>Bluetooth</i> communication
K	Enclosure opening for optional communication via RS485
L	Rotary switches for setting the country standard and display language
M	Enclosure opening for connecting the optional multi-function relay or additional fan kit
N	Slot for SD card
O	Earth terminal for additional earthing of the inverter
P	Enclosure opening for installing a fan (available as an additional fan kit)

* optional

6.3 Connection to the Electricity Grid (AC)

6.3.1 Conditions for the AC Connection

- Comply with the connection requirements of your network operator.

Residual-current protective device

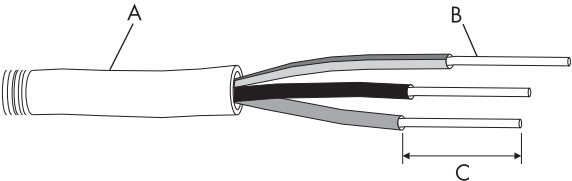
The inverter is equipped with an integrated all-pole-sensitive residual-current monitoring unit. The inverter can automatically differentiate between residual currents and normal leading leakage currents. If the network operator stipulates a residual-current protective device, you must use a residual-current protective device that triggers in the event of a residual current of 100 mA or more.

Further information on the use of a residual-current protective device can be found in the Technical Information "Criteria for Selecting an RCD" at www.SMA.de/en.

Cable design

Use Sunny Design version 2.0 or higher to dimension the conductor cross-section (see "Sunny Design" design program at www.SMA.de/en).

Cable requirements



Object	Description	Value
A	External diameter	12 mm ... 21 mm
B	Conductor cross-section	Maximum 10 mm ²
C	Stripping length	Approx. 12 mm

Connection of a Second Protective Conductor

The inverter is equipped with a protective conductor monitoring function, which detects a failure in the installation of the inverter if no protective conductor is installed. At some supply voltage termination points, it may be useful to deactivate this monitoring function.

To ensure safety standards equivalent to IEC 62109, the protective earth terminal must be planned in one of the following ways if this is the case:

- Installation of the protective conductor on the AC terminal with a conductor cross-section of at least 10 mm² Cu.

or

- Installation of a second protective conductor on the earth terminal with the same cross-section as the original protective conductor on the AC terminal (see Section 6.3.3 "Additional Earthing of the Enclosure" (page 38)).

In some installation countries, a second protective conductor is a general requirement to prevent a contact current in the event of a malfunction in the original protective conductor.

You must always observe the applicable regulations in the installation country.

Load Disconnect Unit



Attach the warning labels on the load disconnect unit on the AC side

To prevent arcing, always disconnect the inverter from the AC **and** DC side before starting work on the PV array.

Attach the warning label "Risk of burns from electric arc" so that it is clearly visible on the external AC disconnection device.

You must install a **separate** miniature circuit-breaker for each inverter in order to ensure that the inverter can be securely disconnected under load. For the maximum permissible fuse protection, see Section 13 "Technical Data" (page 92).

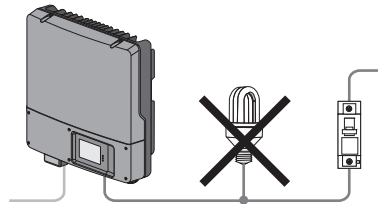
For detailed information and examples of miniature circuit-breaker design, see the Technical Information "Miniature Circuit-Breaker" at www.SMA.de/en.

	<p>DANGER! Danger to life due to fire.</p>
<p>When more than one inverter is connected in parallel to the same miniature circuit-breaker, the protective function of the miniature circuit-breaker is no longer guaranteed. It can result in a cable fire or destruction of the inverter.</p> <ul style="list-style-type: none"> • Never connect multiple inverters to the same miniature circuit-breaker. • Observe the maximum permissible fuse protection of the inverter when selecting the miniature circuit-breaker. 	

**DANGER!****Danger to life due to fire.**

When a generator (inverter) and a load are connected to the same miniature circuit-breaker, the protective function of the miniature circuit-breaker is no longer guaranteed. The current from the inverter and the electricity grid can accumulate to overcurrents which are not detected by the miniature circuit-breaker.

- Never connect loads between the inverter and the miniature circuit-breaker without fuse protection.
- Always protect loads separately.

**NOTICE!****Damage to the inverter by using screw-type fuses as a load disconnect unit**

A screw-type fuse, e.g. DIAZED fuse or NEOZED fuse, is not a switch-disconnector and thus may **not** be used as a load disconnect unit. A screw-type fuse only acts as cable protection.

When disconnecting under load using a screw-type fuse, the inverter may be damaged.

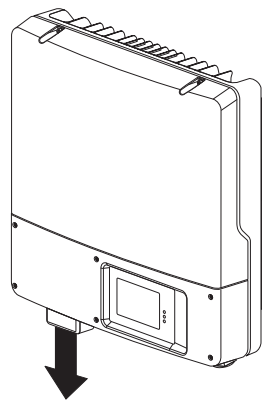
- Use only a switch-disconnector or a miniature circuit-breaker as a load disconnect unit.

6.3.2 Connecting the Inverter to the Electricity Grid (AC)

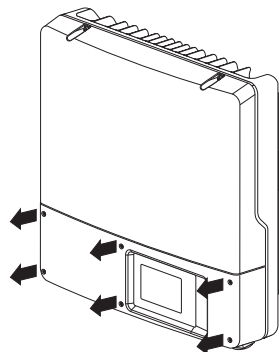
1. Make sure that the line voltage lies within the permissible voltage range.

The exact operating range of the inverter is specified in the operating parameters. The corresponding documents are available in the download area at www.SMA.de/en, in the "Technical Description" category of the respective inverter.

2. Shut down the circuit breaker and secure it to prevent reactivation.
3. If an external DC switch-disconnector is used, disconnect it.
4. If an ESS is used, remove the ESS.



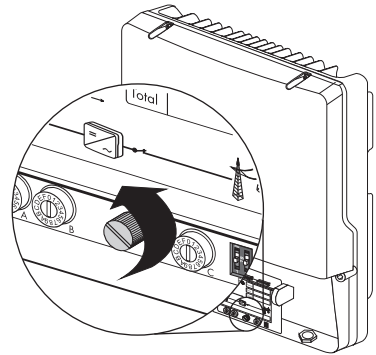
5. Loosen all six captive screws and remove the lower enclosure lid. Use an Allen key (width across flats 3) for this.



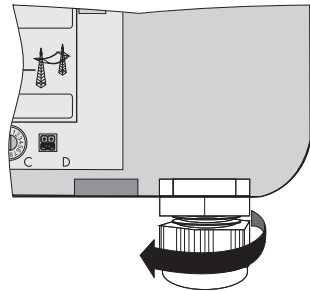
6. Check that the country setting of the inverter is correct by using the supplementary sheet provided with the default settings.

If the inverter is not set to the desired country standard, then adjust the country standard (see Section 6.5.2 "Setting the Country Standard and Language using the Rotary Switch" (page 51)).

7. For easy connection, loosen the display screw until the display can be raised.



8. Flip up the display until it clicks into place.
9. Undo the swivel nut of the AC cable gland and remove the filler-plug from the cable gland.

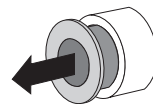


Seal in the AC cable gland

There is a two-part seal in the cable gland. Remove the internal insert if necessary, e.g. to lay a thicker cable.

The following guideline values apply:

- Core cross-section with seal and insert: 12 mm ... 16 mm
- Core cross-section with seal only and without insert: 15 ... 21 mm



10. Pull the cable through.
11. Raise all 3 terminals of the AC terminal as far as they will go.

**NOTICE!****Risk of fire when connecting 2 conductors to a single terminal**

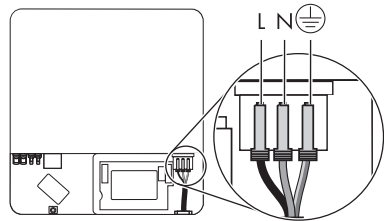
If 2 conductors are connected to one terminal, a poor electrical contact can result in overheating or a risk of fire.

- Never connect more than one conductor per terminal.

12. Connect L, N and the protective conductor (PE) to the AC terminal in accordance with the label.

The protective conductor must be 5 mm longer than the insulated L and N conductors.

L and N must not be swapped.

**CAUTION!****Danger of crushing when terminals snap shut**

The terminals close by snapping down fast and hard.

- Press the terminals down with your thumb, do not grip the entire terminal on all sides.
- Keep fingers away from the terminals.

13. Close all terminals of the AC terminal again until they snap into place.
 14. Fold down the display and screw it hand-tight.
 15. Hand-tighten the swivel nut firmly to the cable gland.

**DANGER!****Danger to life due to high voltages in the inverter**

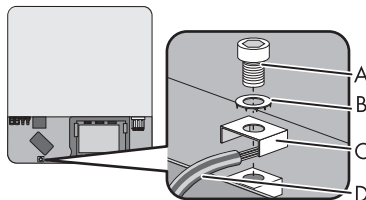
- Do not switch on the miniature circuit-breaker until the PV array has been connected and the inverter is securely closed.

16. Attach the enclosed warning label "Risk of burns from electric arc" so that it is clearly visible on the load disconnect unit on the AC side.

6.3.3 Additional Earthing of the Enclosure

If required in the installation country, you can use the earth terminal on the enclosure to connect a second protective conductor or as equipotential bonding.

1. Undo screw (A) half way. Use an Allen key (width across flats 4) for this.
 2. Insert the stripped earthing cable (D) under the clamping bracket (C) (maximum conductor cross-section 10 mm²).
 3. Fasten terminal (C):
 - Attach conical spring washer on the screw. Here, the grooved side of the conical spring washer must point to the screw head.
 - Tighten the screw (torque: 6 Nm). Use an Allen key (width across flats 4) for this.
- ☒ The teeth of the conical spring washer are pushed into the clamping bracket. The conductive earthing cable is conductively connected to the enclosure.



6.4 Connecting the PV Array (DC)

6.4.1 Conditions for the DC connection



Use of Y adaptors

Y adaptors must not be visible or freely accessible within close proximity of the inverter.

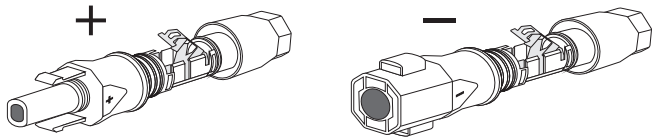
- The DC circuit must not be interrupted by Y adaptors.
- Observe the procedure for disconnecting the inverter (see Section 8.2 "Disconnecting the Inverter from Voltage Sources" (page 62)).
- Requirements for the PV modules of the connected strings:
 - Same type
 - Same quantity of PV modules connected in series
 - Identical alignment
 - Identical tilt
- The connection cables of the PV modules must be equipped with connectors. The DC connectors for the DC connection are included in the delivery.
- The following limiting values at the DC input of the inverter must not be exceeded:

Maximum input voltage	Maximum input current
750 V (DC)	15.0 A (DC)

6.4.2 Assembling the DC Connectors

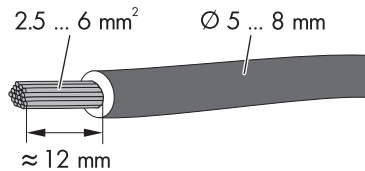
Prior to inverter connection, all PV display module connection cables must be equipped with the DC connectors supplied.

Assemble the DC connectors as follows. Ensure the connectors have the correct polarity. The DC connectors are marked with the symbols "+" and "–".



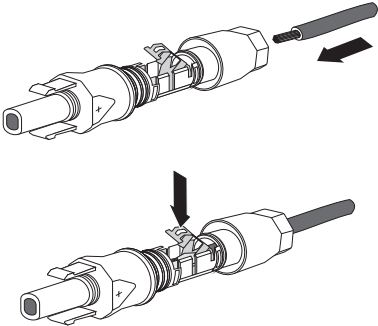
Cable requirements

- Use a PV1-F cable.

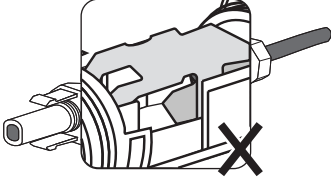
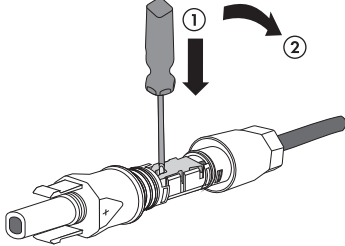


Procedure

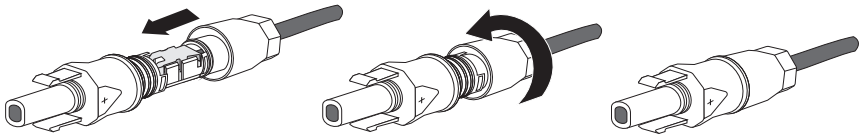
1. Lead the stripped cable all the way into the DC connector.
2. Press the clamping bracket down until it audibly snaps into place.
3. Ensure that the cable is correctly positioned:



Result	Measure
<div><input checked="" type="checkbox"/> If the stranded wire is visible in the chamber of the clamping bracket, the cable is correctly positioned.</div> <div></div>	<div><ul style="list-style-type: none">• Proceed to step 4.</div>

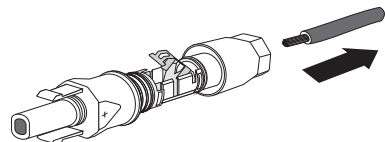
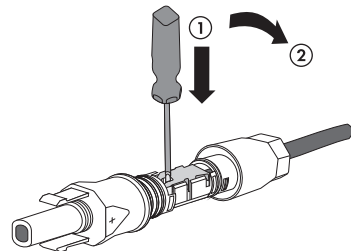
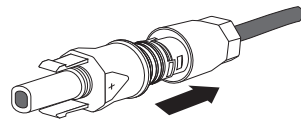
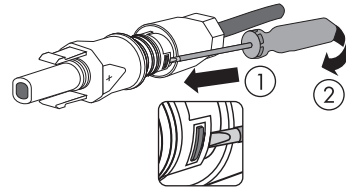
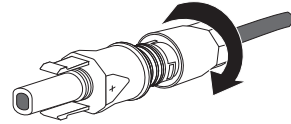
Result	Measure
<p>☑ If the stranded wire is not visible in the chamber, the cable is not correctly positioned.</p> 	<ul style="list-style-type: none"> Release the clamping bracket. To do so, insert a 3.5 mm screwdriver into the clamping bracket and lever it open.  <ul style="list-style-type: none"> Remove the cable and go back to step 1.

4. Push the swivel nut up to the thread and tighten (torque: 2 Nm).



6.4.3 Opening the DC Connector

1. Unscrew the swivel nut.
2. To release the DC connector: Insert a 3.5 mm screwdriver into the snap slot on the side and lever it open.
3. Carefully pull the DC connector apart.
4. Release the clamping bracket. To do so, insert a 3.5 mm screwdriver into the clamping bracket and lever it open.
5. Remove the cable.



6.4.4 Connecting the PV Array (DC)



DANGER!

Danger to life due to high voltages in the inverter

- Before connecting the PV array, switch off the miniature circuit-breaker and make sure that it cannot be reconnected.



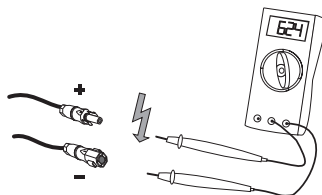
NOTICE!

Excessive voltages can destroy the measuring device

- Only use measuring devices with a DC input voltage range up to at least 1 000 V.

1. Check the connection cable of the PV modules for correct polarity and make sure that the maximum input voltage of the inverter is not exceeded.

At an ambient temperature above 10 °C, the open-circuit voltage of the PV modules must not be more than 90% of the maximum inverter input voltage. Otherwise, check the plant design and the PV module circuitry. At lower ambient temperatures, the maximum input voltage of the inverter could otherwise be exceeded.



NOTICE!

Destruction of the inverter due to overvoltage

If the voltage of the PV modules exceeds the maximum input voltage of the inverter, it can be destroyed by the overvoltage. This will void all warranty claims.

- Do not connect strings with an open-circuit voltage greater than the maximum input voltage of the inverter.
- Check the plant design.

2. Check strings for earth faults (see Section 11.5 "Checking the PV Array for Earth Faults" (page 82)).



DANGER!

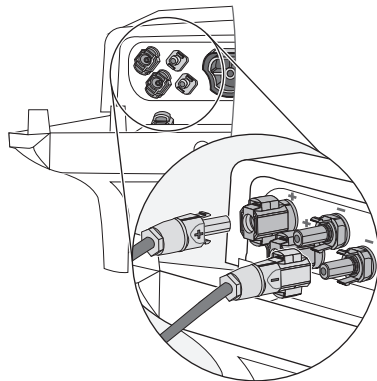
Danger to life due to electric shock.

- Do not connect any strings in which earth faults are present.
- Before connecting the DC cable, rectify the earth fault in the respective string.

3. Check the DC connectors for correct polarity and connect them.

☑ The DC connectors click audibly into position.

For details on how to release the DC connectors, see Section 8.2 "Disconnecting the Inverter from Voltage Sources" (page 62).

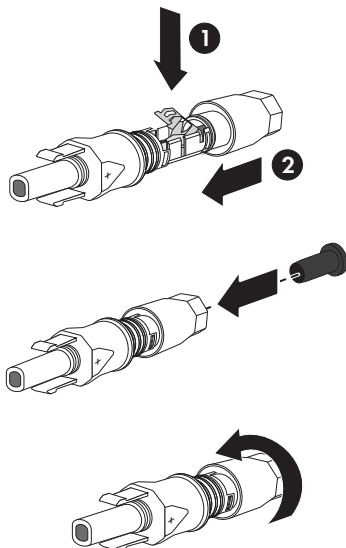


4. If you do not need all DC inputs on the inverter, seal the enclosure with DC connectors and sealing plugs:

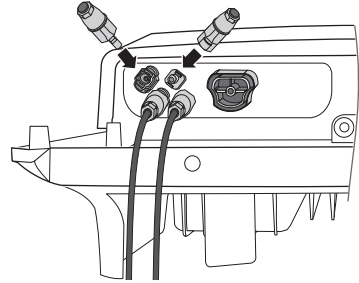


Sealing plugs

- Do **not** insert the sealing plugs **directly** into the DC inputs on the inverter.
- For unused DC connectors, push down the clamping bracket and push the swivel nut up to the thread.
- Insert the sealing plug into the DC connectors.
- Tighten the swivel nut (torque: 2 Nm).

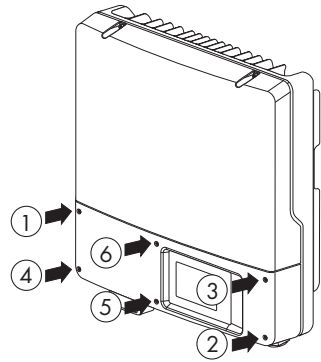


- Insert the DC connectors with sealing plugs into the corresponding DC inputs on the inverter.
- ☑ The DC connectors click audibly into position.

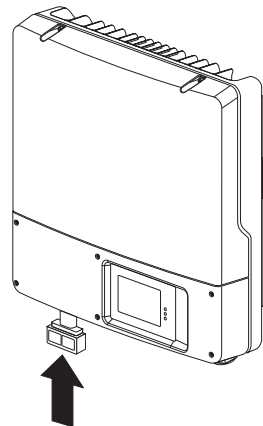


5. Ensure that all DC connectors are securely in place.
6. Close the lower enclosure lid again using the 6 screws.

Tighten the screws (2 Nm torque) in the order shown on the right.



7. If an ESS is used, check it for wear as described in Section 9.3 "Checking the Electronic Solar Switch for Wear" (page 68) and reattach it firmly.

**NOTICE!****ESS damage.**

If it is not connected correctly, the ESS can be damaged.

- Plug the handle firmly onto the jack of the ESS.
- The handle must be flush with the enclosure.
- Make sure that the ESS is securely attached to on the inverter.

**Currents in DC cabling**

After connecting the ESS or switching on the DC switch-disconnector, DC currents may occur in the DC cabling, even when there is no AC-side supply. This is not an error but normal behaviour of the inverter when in operation.

- ☒ The PV array is connected. You can now commission the inverter (see Section 7 "Commissioning" (page 54)). Other connection options are optional (see Section 6.6 "Communication" (page 52)).

6.5 Setting the Country Standard and Display Language

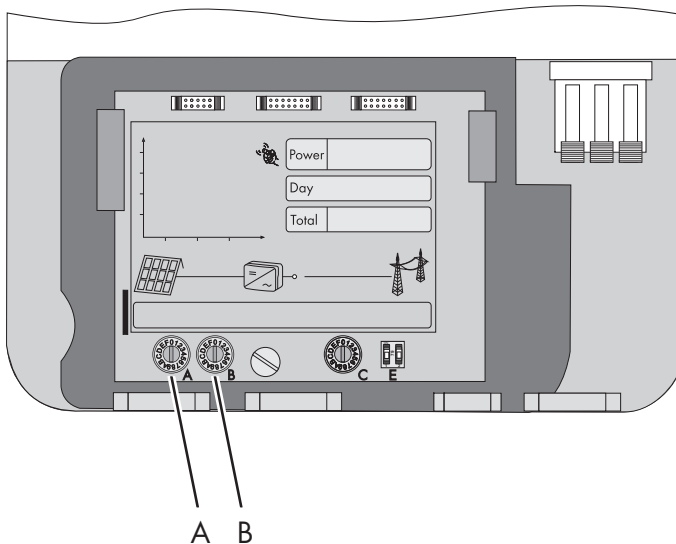
The inverter can be configured for various countries. This can be done prior to commissioning via 2 rotary switches on the display or after commissioning by configuring the "CntrySet" or "Set country standard" parameter using a communication product (e.g. Sunny WebBox or Sunny Explorer). For devices ordered without any specified country of installation, the default country data set is "VDE-AR-N4105-HP" and the display language is set to German.

Both rotary switches are set to 0 upon delivery. If you have ordered the inverter with specific country settings, they will have already been preset at the factory via a communication product. In this case, you will not be able to recognise the current setting by the switch position.

If changes are made via the rotary switches or via a communication product, the default grid parameters are overwritten. They cannot be restored, and must be re-entered via a communication product.

The display language can be changed at any time using the rotary switches, independent of the grid parameters. This means that the default grid parameters remain unchanged, but the display messages are shown in the set language.

Changes will be accepted immediately after switching the miniature circuit-breaker on. If an unprogrammed switch setting is selected, the inverter displays an error message. The last valid setting is retained.



SMA Grid Guard-Protected Country Data Sets

In some countries, the local connection conditions demand a mechanism which prevents the parameters for the feed-in from being changed. Therefore, certain country data sets are protected against unauthorised changes. They can only be unlocked with a personal access code - the SMA Grid Guard code.

SMA Grid Guard-protected country data sets are automatically blocked for 10 feed-in hours after commissioning, or after the last alteration. If the country data set is changed after these 10 feed-in hours, the inverter does not accept the changes and displays the error message "Grid param. locked". If, however, a later change to the country data set only relates to a change of the display language via the rotary switches in the inverter, this change is immediately applied.

It is also possible to set country data sets (parameter "CntrySet" or "Set country standard"), and to lock or unlock these manually via a communication product. To lock a data set, enter the digit sequence "54321" instead of the password into the SMA Grid Guard code field. The data set can only be unlocked by entering a personal, 10-digit SMA Grid Guard code which is valid for a maximum of 10 feed-in hours. The application form for the personal access code is available at www.SMA.de/en, in the "Certificate" category of the respective inverter.

The language can be configured without a password, regardless of the country data set.



Changing parameters in SMA Grid Guard-protected country data sets

If the parameters within protected country data sets are changed, these are no longer protected and instead of the standard, "ADJ" or "Special setting" is displayed. In this case, a change to parameters is not locked automatically after 10 feed-in hours, but has to be locked manually. To manually lock the parameters, set the SMA Grid Guard code to "54321".



Further information on parameter settings

For detailed information on making adjustments and changing parameters, see the corresponding user manual for your communication product.

The last change (executed via rotary switch or communication product) is always verified and activated if applicable. Consequently, the switch position may not necessarily show the actual country setting.

6.5.1 Checking the Country Standard

Make sure that the inverter is set to the installation country.

Before commissioning:

- Check that the country standard of the inverter is correct using the supplementary sheet provided and compare this to the default settings of the inverter.

After commissioning:

- Check that the country standard is correct on the basis of the display message during (re-)commissioning (see Section 7 "Commissioning" (page 54)).
- Check whether the country standard is correct by tapping the display twice and viewing the display messages of the startup phase again.
or
- Check that the country standard is correct using the "SMA grid guard" measuring channel via a communication product.



Display language

Once you have set the country standard, you can always set the display language later using rotary switch B. However, you have to then set rotary switch A to "0" in order to keep the country data set.

The settings of each country data set are specified in the operating parameters. The parameters can be read out using a communication product. The description of the operating parameters is available at www.SMA.de/en in the category "Technical Description" of the respective inverter.

(A)	(B)	Country data set	Display language	Grid Guard protection	Country
0	0	Default settings	Default settings	Dependent on parameter set	Dependent on parameter set
0	1	Retained	English	Dependent on parameter set	Dependent on parameter set
0	2	Retained	German	Dependent on parameter set	Dependent on parameter set
0	3	Retained	French	Dependent on parameter set	Dependent on parameter set
0	4	Retained	Spanish	Dependent on parameter set	Dependent on parameter set
0	5	Retained	Italian	Dependent on parameter set	Dependent on parameter set
0	6	Retained	Greek	Dependent on parameter set	Dependent on parameter set
0	7	Retained	Czech	Dependent on parameter set	Dependent on parameter set

(A)	(B)	Country data set	Display language	Grid Guard protection	Country
0	8	Retained	Korean	Dependent on parameter set	Dependent on parameter set
0	9	Retained	Portuguese	Dependent on parameter set	Dependent on parameter set
0	A	Retained	Dutch	Dependent on parameter set	Dependent on parameter set
0	B	Retained	Slovenian	Dependent on parameter set	Dependent on parameter set
0	C	Retained	Bulgarian	Dependent on parameter set	Dependent on parameter set
0	D	Retained	Polish	Dependent on parameter set	Dependent on parameter set
1	0	VDE0126-1-1	German	Yes	Germany, Switzerland,
1	2	VDE-AR-N4105 ^{a)}	German	Yes	Germany
1	4	VDE-AR-N4105-MP ^{b)}	German	Yes	Germany
1	6	VDE-AR-N4105-HP ^{c)}	German	Yes	Germany
1	8	VDE0126-1-1	French	Yes	Switzerland, France
1	9	VDE0126-1-1/UTE ^{d)} *	French	Yes	France
2	0	VDE0126-1-1	Italian	Yes	Switzerland
4	0	RD1699*	Spanish	Yes	Spain
4	1	RD1663/661-A*	Spanish	Yes	Spain
4	8	PPC*	Greek	No	Greece
4	9	PPC*	English	No	Greece
5	8	G83/1-1	English	No	England
5	A	G59/2	English	No	England
6	0	EN50438*	German	Yes	Various EU countries
6	1	EN50438*	English	Yes	Various EU countries
6	2	EN50438*	French	Yes	Various EU countries
6	3	EN50438*	Italian	Yes	Various EU countries
6	4	EN50438*	Spanish	Yes	Various EU countries

(A)	(B)	Country data set	Display language	Grid Guard protection	Country
6	5	EN50438*	Greek	Yes	Various EU countries
6	6	EN50438*	Czech	Yes	Various EU countries
6	7	EN50438*	Portuguese	Yes	Various EU countries
6	8	EN50438*	Bulgarian	Yes	Various EU countries
6	9	EN50438*	Polish	Yes	Various EU countries
7	0	EN50438-CZ*	Czech	Yes	Czech Republic
7	1	EN50438-CZ*	English	Yes	Czech Republic
7	2	EN50438-CZ*	German	Yes	Czech Republic
7	4	PPDS*	Czech	Yes	Czech Republic
7	5	PPDS*	English	Yes	Czech Republic
7	6	PPDS*	German	Yes	Czech Republic
7	8	C10/11	French	Yes	Belgium
7	9	C10/11	English	Yes	Belgium
7	A	C10/11	German	Yes	Belgium
C	0	Customer	English	No	Flexible
C	1	Customer	German	No	Flexible
C	2	Customer	French	No	Flexible
C	3	Customer	Spanish	No	Flexible
C	4	Customer	Italian	No	Flexible
C	5	Customer	Greek	No	Flexible
C	6	Customer	Czech	No	Flexible
D	0	Off-Grid 60 Hz*	English	No	Flexible
D	1	Off-Grid 60 Hz*	German	No	Flexible
D	2	Off-Grid 60 Hz*	French	No	Flexible
D	3	Off-Grid 60 Hz*	Spanish	No	Flexible
D	4	Off-Grid 60 Hz*	Italian	No	Flexible
D	5	Off-Grid 60 Hz*	Greek	No	Flexible
D	6	Off-Grid 60 Hz*	Czech	No	Flexible
E	0	Off-Grid 50 Hz*	English	No	Flexible
E	1	Off-Grid 50 Hz*	German	No	Flexible
E	2	Off-Grid 50 Hz*	French	No	Flexible
E	3	Off-Grid 50 Hz*	Spanish	No	Flexible


(A)	(B)	Country data set	Display language	Grid Guard protection	Country
E	4	Off-Grid 50 Hz*	Italian	No	Flexible
E	5	Off-Grid 50 Hz*	Greek	No	Flexible
E	6	Off-Grid 50 Hz*	Czech	No	Flexible
a) Setting in accordance with VDE-AR-N-4105 for PV plants ≤ 3.68 kVA (Germany)					
b) Setting in accordance with VDE-AR-N-4105 for PV plants > 3.68 kVA and < 13.8 kVA (Germany)					
c) Setting in accordance with VDE-AR-N-4105 for PV plants > 13.8 kVA (Germany)					
d) Special setting for France: Bluetooth transmission power reduced in accordance with French requirements					
* Planned					

If the inverter is not set to the installation country, there are several ways of configuring the required country standard:

- Setting via the 2 rotary switches (see Section 6.5.2 "Setting the Country Standard and Language using the Rotary Switch" (page 51)).
- Alternatively you can conduct the settings via the "CntrySet" or "Set country standard" parameters with a communication product, once you have commissioned the inverter.
- If you require adjusted parameter settings for your installation site, you can change these with the help of a communication product.

6.5.2 Setting the Country Standard and Language using the Rotary Switch

1. Disconnect the inverter and open it (see Section 8.2 "Disconnecting the Inverter from Voltage Sources" (page 62)).



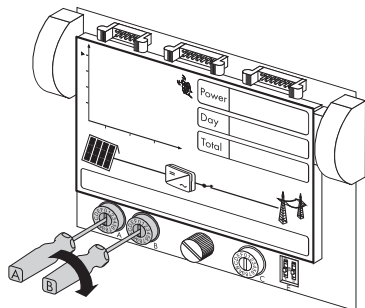
DANGER!

Danger to life due to high voltages in the event of grid failure

If you set the inverter to stand-alone grid operation "Off-Grid 50 Hz"/"Off-Grid 60 Hz", you are not allowed to operate the inverter on the electricity grid, but only on the stand-alone grid, because the inverter does not satisfy any country-specific standards and guidelines in this setting. If there is an electricity grid failure, this prevents danger of backfeed.

- If the inverter is set to "Off-Grid 50 Hz" or "Off-Grid 60 Hz", never operate the inverter directly on the electricity grid.

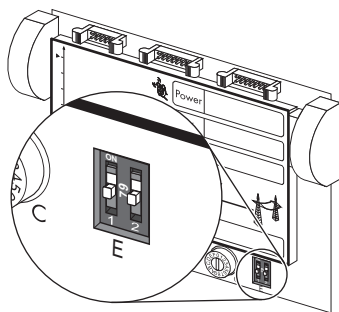
2. Set the arrows on both rotary switches (A and B) to the required positions using a screwdriver (see table in Section 6.5.1 "Checking the Country Standard" (page 48)). To do this, use a screwdriver with a blade width of 2.5 mm.



Temporarily setting the display language to English

You can also temporarily set the display language to English by means of a switch, e.g. for service purposes. The inverter's parameter settings are not changed in the process.

- Push the left switch 1 up until it locks into place. Use an object with a small tip, e.g. a ballpoint pen, to do this.
- To reset the display language to the original language, push the left switch 1 back down until it locks into place.



3. Close the inverter (see Section 8.3 "Closing the Inverter" (page 65)).

6.6 Communication

6.6.1 Interface for RS485 Communication

If you have ordered an inverter with an interface for wired communication, the interface is installed upon delivery.

You can also subsequently order an interface for wired communication (see Section 14 "Accessories" (page 98)). You will find a detailed illustration of the wiring principle and the description for the subsequent installation in the communication interface retrofit kit.

6.6.2 Setting the *Bluetooth* NetID

Communication via *Bluetooth* with a communication product is activated as standard. Networking via *Bluetooth* with other inverters is deactivated as standard.

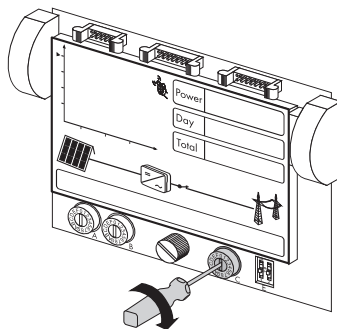
The following configuration settings are possible via a rotary switch (switch C):

Switch position (NetID)	Setting
0	<i>Bluetooth</i> communication is deactivated.
1	Communication via <i>Bluetooth</i> is activated using a communication product and networking with other inverters is deactivated. (default setting)
2 ... F	Networking via <i>Bluetooth</i> with other inverters is activated.

In order to restrict communication via *Bluetooth* between the inverters of your PV plant and those of neighbouring systems, you can assign an individual NetID to the inverters of your PV plant (switch position 2 ... F). However, this is only necessary if neighbouring plants are within a radius of 500 m.

So that all inverters in your PV plant are detected by your communication product, all inverters must have the same NetID.

1. Disconnect the inverter and open it (see Section 8.2 "Disconnecting the Inverter from Voltage Sources" (page 62)).
2. Set the arrow on the rotary switch (C) to the required position using a screwdriver. Use a 2.5 mm screwdriver for this purpose.
3. Close the inverter (see Section 8.3 "Closing the Inverter" (page 65)).



Acceptance of settings

The *Bluetooth* settings will only be applied when the inverter is commissioned.

6.6.3 Multi-Function Relay

If you have ordered an inverter with a multi-function relay, the multi-function relay is installed upon delivery. You can subsequently order a multi-function relay (for order number, see Section 14 "Accessories" (page 98)).

The description of the installation and the electrical connection can be found in the installation manual of the multi-function relay.

You can find detailed information on the configuration of the multi-function relay in the Technical Description "Multi-functional relay and OptiTrac Global Peak" at www.SMA.de/en.

7 Commissioning

7.1 Commissioning the Inverter

1. The following conditions must be fulfilled before commissioning:
 - Correct mounting (see Section 5.3)
 - Correct country setting (see Section 6.5.1).
 - AC cable is correctly connected (electricity grid)
 - Protective conductor is correctly connected (see Section 6.3.3)
 - DC cables (PV strings) are completely connected
 - Unused DC inputs are closed using the corresponding DC connectors and sealing plugs
 - All enclosure openings are closed.
 - The enclosure lid is securely screwed into place
 - An external DC switch-disconnector is connected or, if applicable, the ESS is firmly in place.
 - The AC distribution board is correctly installed
 - The miniature circuit-breaker is correctly sized.

2. Switch on the miniature circuit-breaker.

☒ Green LED is lit: commissioning was successful.

or

☒ Green LED flashes in case of insufficient irradiation: grid connection conditions have not yet been reached. Wait for sufficient irradiation.

or

☒ Red LED is lit: a disturbance has occurred. Locate and eliminate the fault (see Section 11 "Troubleshooting" (page 70)).



Self-test in accordance with ENEL guideline during initial start-up (only for Italy)

The Italian standard prescribes that an inverter can only operate on the electricity grid after the disconnection times for overvoltage, undervoltage, minimum frequency and maximum frequency have been checked.

If you have configured the Enel-GUIDA country data set, start the self-test (see Section 7.3 "Self-test in Accordance with ENEL Guideline (Only for Italy)" (page 56)). The test takes approx. 3 minutes.





3. If connected, switch on the multi-function relay supply voltage.
4. For communication via *Bluetooth*, make the following settings:
 - Change the plant time (see the manual of the communication product).
 - Change the passwords (see the manual of the communication product).

7.2 Display Messages during the Start Phase



Illustrated display messages

The display messages illustrated in this section serve as examples and depending on the country setting, may differ from the display messages of your inverter.

- Firstly, the firmware version of the internal processors appears in the text line.

- After 5 seconds, or after tapping on the display, the serial number or the description of the inverter and the NET ID for communication via *Bluetooth* will appear. The designation of the inverter can be changed with a communication product.

- After a further 5 seconds, or after a further tap, the configured country standard is displayed (example: "VDE-AR-N4105-MP").

- After a further 5 seconds, or after a further tap, the configured language is displayed (example: "Sprache Deutsch" (Language German)).

- During normal operation, the text line of the display will be clear. See Section 11 "Troubleshooting" (page 70) for possible event messages which may be displayed in the text line and their meaning.



Showing display messages again

If you want to view the display messages of the start phase again whilst in normal operation, double-tap the display.

7.3 Self-test in Accordance with ENEL Guideline (Only for Italy)

7.3.1 Starting the Self-Test

You can start the self-test by tapping on the lower enclosure lid. The country setting of the inverter must be set to Italy (Enel-GUIDA) or a reconfiguration based on the Enel-GUIDA country data set before the self-test has been carried out. In addition, an undisturbed feed-in operation must be possible.



Display language during the self-test

Independent of the configured language, the display messages for the self-test will always be displayed in Italian.

Proceed as follows for checking the disconnection times:

1. Commission the inverter (see Section 7 "Commissioning" (page 54)).
 - ☒ The inverter is now in the start phase.
 - Firstly, the firmware version of the internal processors appears in the text line.
 - After 5 seconds or after you tap the lower enclosure lid, the serial number or the designation of the inverter appears. The designation of the inverter can be changed with a communication product.
 - After a further 5 seconds, or when you tap again, the configured standard is displayed.
2. In order to start the self-test, tap once on the lower enclosure lid **within 10 seconds**.
 - ☒ The display message on the right is shown.
3. Now activate the self-test **within 20 seconds** by tapping on the lower enclosure lid again.
 - ☒ Once you have started the test sequence, the inverter consecutively checks the disconnection times for overvoltage, undervoltage, maximum frequency and minimum frequency. During the tests, the inverter shows the values in the display which are described in Section 7.3.2 "Test Sequence" (page 57).

ENEL-GUIDA

AVVIO AUTOTEST

7.3.2 Test Sequence

Note the values which are displayed during the test sequence. These values must be entered into a test report. The test results of the individual tests are displayed 3 times one after the other. During the test sequence, the inverter will not react to tapping.

When the inverter has carried out the 4 tests, it switches to normal operation. The original calibration values are reset.



Current values in the display

During the self-test, the current voltage, the feed-in current and the frequency are displayed above the text line independently of the test values.

Overvoltage Test

The inverter starts with the overvoltage test and shows the adjacent display message for 5 seconds.

AUTOTEST V AC MAX

During the test sequence, the voltage limit applied is shown in the display of the inverter. The voltage limit is reduced successively until the disconnection threshold is reached and the inverter disconnects from the electricity grid.

V AC MAX 245,0 V

Once the inverter has disconnected from the electricity grid, the display successively shows each of the following values for 10 seconds:

- Disconnection value

1. VALORE DI 233,0 V

2. SOGLIA COM 233,0 V

- Calibration value

1. VALORE DI 276,0 V

2. TARATURA 276,0 V

- Reaction time

1. TEMPO 0,08 S

2. INTERVENTO 0,08 S

The change between the first and second display takes place every 2.5 seconds.

Undervoltage Test

The undervoltage test follows the overvoltage test and the inverter shows the adjacent display message for 5 seconds.

During the test sequence, the voltage limit applied is shown in the display of the inverter. The voltage limit is increased successively until the disconnection threshold is reached and the inverter disconnects from the electricity grid.

Once the inverter has disconnected from the electricity grid, the display successively shows each of the following values for 10 seconds:

- Disconnection value

1. VALORE DI 232,0 V

2. SOGLIA COM 232,0 V

- Calibration value

1. VALORE DI 184,0 V

2. TARATURA 184,0 V

- Reaction time

1. TEMPO 0,15 S

2. INTERVENTO 0,15 S

The change between the first and second display takes place every 2.5 seconds.

Maximum Frequency

The maximum frequency test follows the undervoltage test and the inverter shows the adjacent display message for 5 seconds.

During the test sequence, the frequency limit applied is shown in the display of the inverter. The frequency limit is reduced successively until the disconnection threshold is reached and the inverter disconnects from the electricity grid.

Once the inverter has disconnected from the electricity grid, the display successively shows each of the following values for 10 seconds:

- Disconnection value

1. VALORE DI 50,05 HZ
2. SOGLIA COM 50,05 HZ

- Calibration value

1. VALORE DI 50,30 HZ
2. TARATURA 50,30 HZ

- Reaction time

1. TEMPO 0,075
2. INTERVENTO 0,075

The change between the first and second display takes place every 2.5 seconds.

Minimum Frequency

After the maximum frequency test, the minimum frequency test takes place and the inverter shows the display message on the right for 5 seconds.

AUTOTEST F AC MIN

During the test sequence, the frequency limit applied is shown in the display of the inverter. The frequency limit is increased successively until the disconnection threshold is reached and the inverter disconnects from the electricity grid.

F AC MIN 49,85 HZ

Once the inverter has disconnected from the electricity grid, the display successively shows each of the following values for 10 seconds:

- Disconnection value
- Calibration value
- Reaction time

1. VALORE DI 50,00 HZ

2. SOGLIA COM 50,00 HZ

1. VALORE DI 49,70 HZ

2. TARATURA 49,70 HZ

1. TEMPO 0,08 S

2. INTERVENTO 0,08 S

The change between the first and second display takes place every 2.5 seconds.

7.3.3 Aborting the Self-Test

If, during the self-test, an unexpected disconnection requirement occurs, the self-test is aborted. The same applies if the DC voltage is so low that feed-in cannot be continued.

- The inverter then shows the adjacent display message for 10 seconds.
- Restart the self-test (see Section 7.3.4 "Restarting the Self-Test" (page 60)).

AUTOTEST INTERROTTO

7.3.4 Restarting the Self-Test

In order to restart the self-test, proceed as follows:

1. Disconnect the miniature circuit-breaker and secure against accidental or inadvertent re-connection.
 2. If a multi-function relay is connected, disconnect its supply voltage.
 3. Disconnect the ESS from the inverter for 5 minutes and connect it again, or switch off the DC switch-disconnector for 5 minutes and then switch it on again.
 4. Commission the inverter again (see Section 7 "Commissioning" (page 54)).
- ☒ The inverter is now in the start phase and you can restart the self-test (see Section 7.3.1 "Starting the Self-Test" (page 56) from step 3).

8 Opening and Closing

8.1 Safety

**DANGER!**

Danger to life due to high voltages in the inverter

Before opening the inverter, observe the following:

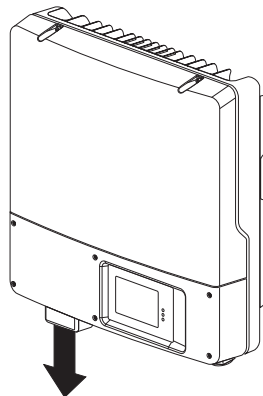
- Disconnect the miniature circuit-breaker and secure against accidental or inadvertent re-connection.
- If a multi-function relay is connected, disconnect its supply voltage and ensure that the device cannot be inadvertently or accidentally reconnected.

**DANGER!**

Danger to life due to electric shock.

If the DC connectors are pulled out without first disconnecting the ESS or switching off the DC switch-disconnector, a dangerous electric arc can occur.

- Disconnect the ESS or switch off the DC switch-disconnector first.
- Open the lower enclosure lid and remove the DC connectors.

**NOTICE!**

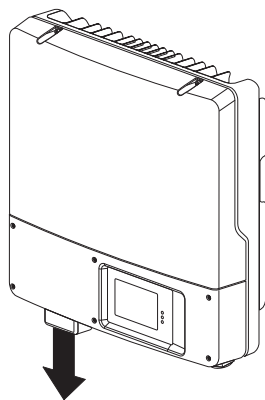
Electrostatic discharge can damage the inverter

The internal components of the inverter can be irreparably damaged by electrostatic discharge.

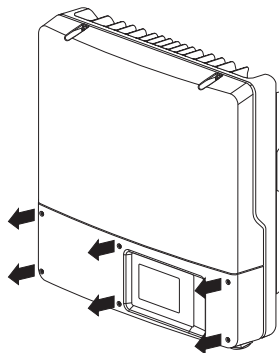
- Earth yourself before touching any components.

8.2 Disconnecting the Inverter from Voltage Sources

1. Disconnect the miniature circuit-breaker and secure against accidental or inadvertent re-connection.
2. If a multi-function relay is connected, disconnect its supply voltage and ensure that the device cannot be unintentionally or inadvertently reconnected.
3. If an external DC switch-disconnector is used, disconnect it.
4. If an ESS is in use, disconnect the ESS.

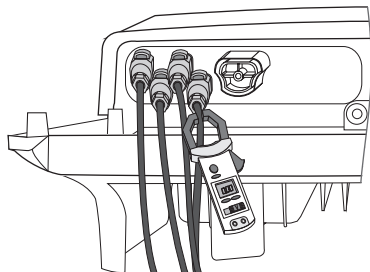


5. Loosen all six captive screws and remove the lower enclosure lid. Use an Allen key (width across flats 3) for this.

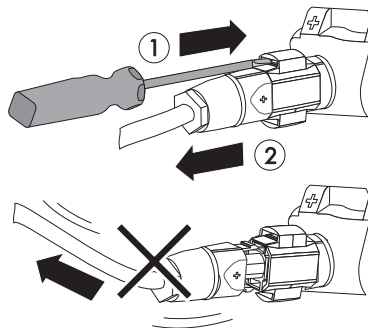


6. Use a current clamp to make sure all DC cables are current free.

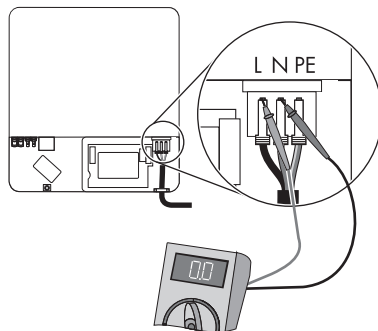
☒ If current is present, check the installation.



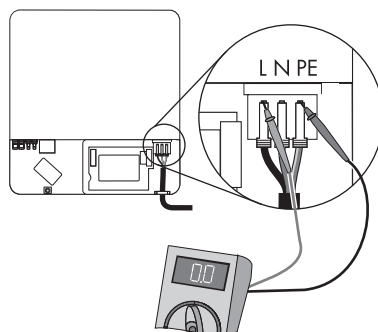
7. Release and disconnect all DC connectors. To do this, insert a flat-blade screwdriver (blade width: 3.5 mm) into one of the side slots and pull the DC connectors straight out. **DO NOT PULL ON THE CABLE** while doing this.



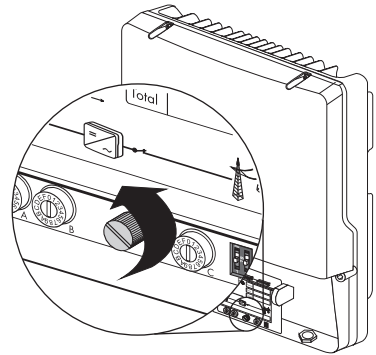
8. Wait until the LEDs, display and, if applicable, fault indicator have gone out.
9. Verify the absence of voltage between L and N at the AC terminal using a suitable measuring device. The maximum diameter of the test probe is 2 mm.
- ☒ If voltage is present, check the installation.



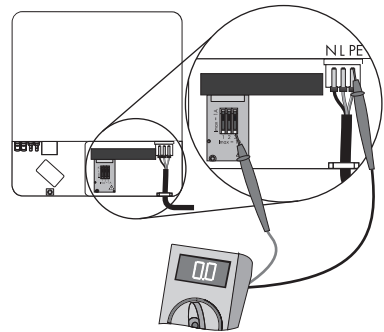
10. Verify that no voltage is present between L and PE at the AC terminal using a suitable measuring device.
- ☒ If voltage is present, check the installation.



11. Loosen the screw on the display and flip the display up until it clicks into place.



12. Verify the absence of voltage in the multi-function relay to the protective conductor at all terminals. The maximum diameter of the test probe is 2 mm.
☒ If voltage is present, check the installation.



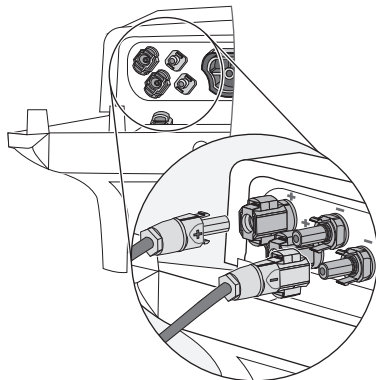
- ☒ The inverter is open and no voltage is present.

8.3 Closing the Inverter

1. Check the DC connectors for correct polarity and connect them to the inverter.

☑ The DC connectors click audibly into position.

For details on how to release the DC connectors, see Section 8.2 "Disconnecting the Inverter from Voltage Sources" (page 62).



2. Close all the DC inputs that are not needed to seal the inverter (see Section 6.4.4 "Connecting the PV Array (DC)" (page 42)).
3. Ensure that all DC connectors are securely in place.



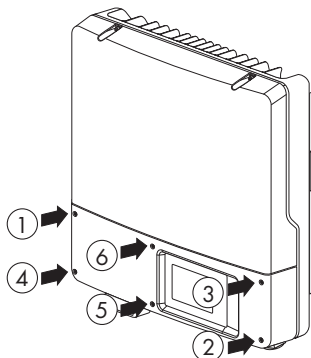
DANGER!

Danger to life due to electric shock.

When the inverter is operated without the lower enclosure lid, the DC connectors can be disconnected while under load, which can cause arcing.

- Insert the ESS only when the lower enclosure lid is closed.
- Only operate the inverter when the lower enclosure lid is closed so that the DC connectors can be removed easily.

4. Attach the lower enclosure lid to the enclosure and lock it with the 6 screws. Use an Allen key (width across flats 3) and tighten the screws (2 Nm torque) in the order shown on the right.

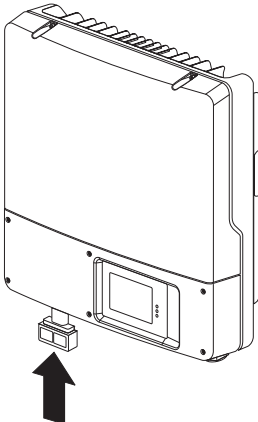


5. If an external DC switch-disconnector is used, disconnect it.
6. If an ESS is used, check it for wear (see Section 9.3 "Checking the Electronic Solar Switch for Wear" (page 68)), and attach it firmly.

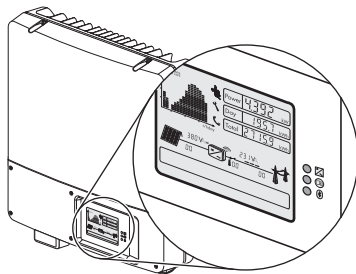
NOTICE!

The ESS can be damaged if it is not plugged in correctly.

- Securely connect the ESS.
- The ESS handle must be flush with the enclosure.
- Check that the ESS is securely in place.



7. If a multi-function relay is connected, switch on the supply voltage.
8. Switch on the miniature circuit-breaker.
9. Check whether the display and the LEDs indicate a normal operating state (see Section 7 "Commissioning" (page 54)).



- ☒ The inverter is now closed and in operation.

9 Maintenance and Cleaning

9.1 Cleaning the Inverter

If the inverter is dirty, clean the enclosure lid, the display and the LEDs with clear water and a cloth only.

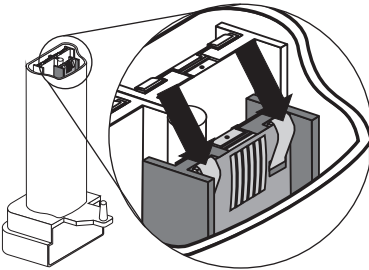
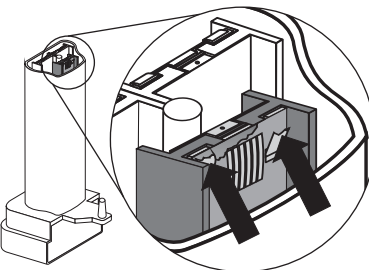
9.2 Checking Heat Dissipation

If the inverter regularly reduces its output due to excessive heat (temperature symbol on the display illuminates), this may be for one of the following reasons:

- The cooling fins on the rear side of the enclosure are clogged with dirt.
 - Clean the cooling fins with a soft brush.
- The air ducts at the top are clogged with dirt.
 - Clean the air ducts with a soft brush.

9.3 Checking the Electronic Solar Switch for Wear

Check the ESS for wear before plugging it in.

Result	Measure
<div><input checked="" type="checkbox"/> The metal tongues inside the plug are not damaged or discoloured.</div> <div></div>	<div><ol style="list-style-type: none">1. Insert the handle of the ESS securely in the jack on the bottom of the enclosure.2. Commission the inverter again (see Section 7 "Commissioning" (page 54)).</div>
<div><input checked="" type="checkbox"/> The metal tongues inside the plug have a brown discolouration or are burned out.</div> <div></div>	<div>The ESS can no longer safely disconnect the DC side.</div> <div><ol style="list-style-type: none">1. Replace the ESS handle before attaching it again. Order the new ESS handle through the SMA Service Line (see Section 15 "Contact" (page 99)).2. After replacing the ESS, commission the inverter again (see Section 7 "Commissioning" (page 54)).</div>

10 Slot for SD Card

The SD card is used to read in files, for instance, if after consulting the SMA Service Line you need to perform a firmware update.

SMA Solar Technology AG will send you a file with the firmware update by e-mail or on an SD card, or will make the file available in the download area at www.SMA.de/en.

For a description of the firmware update, see the download area at www.SMA.de/en.



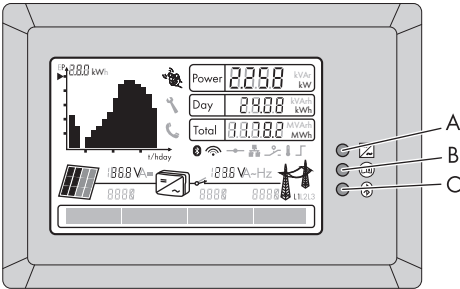
Properties of the SD card

Use an SD card that is FAT16 or FAT32 formatted and has a maximum storage capacity of 2 GB.

Use the SD card exclusively for this inverter. Do not save any multimedia files or other unsuitable files on the SD card.

11 Troubleshooting

11.1 LED Signals



Position	Designation	Status	Explanation
A	Green LED	Glowing	Operation
		Flashing	Grid connection conditions are not yet met.
B	Red LED	Glowing	Error
C	Blue LED	Glowing	Bluetooth communication is activated.
		Flashing	The inverter has been identified via Sunny Explorer by setting the "Find device" parameter.

11.2 Event Messages



No display if DC voltage is insufficient

Measurements can only be made and messages displayed when there is sufficient DC voltage.

During an update, the relevant display message is shown in the text line of the display.

Message	Description
Avvio Autotest	Only relevant for an installation in Italy: tapping on the display starts the self-test in accordance with Enel-GUIDA (see Section 7.3 "Self-test in Accordance with ENEL Guideline (Only for Italy)" (page 56)).
Inst. code valid	The SMA Grid Guard code entered is valid. The configured country data set is now unlocked and can be changed. If it is a Grid Guard-protected country data set, the unlocking is valid for a maximum of 10 feed-in hours.
No new update SDcard	There is no update file relevant for this inverter on the SD card or the available update has already been carried out.
Grid param.unchanged	The selected switch setting is not programmed or there is no country data set available on the SD card.
Parameters set successfully	A new country data set has been configured.
SD card is read	The inverter is currently reading the SD card.
Set parameter	The inverter is setting the configured parameters.
Update completed	The inverter has successfully completed the update.
Update Bluetooth	The inverter is updating the <i>Bluetooth</i> component.
Update main CPU	The inverter is updating the inverter component.
Update communication	The inverter is updating the communication component.
Update RS485I module	The inverter is updating the communication interface.
Upd. language table	The inverter is updating the language table.
Update file OK	The update file found is valid.

11.3 Error Messages



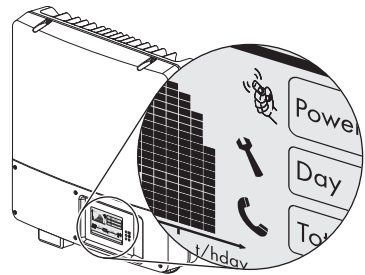
No display if DC voltage is insufficient

Measurements can only be made and messages displayed when there is sufficient DC voltage.

The text line on the display shows the relevant messages whenever an error occurs. The event numbers for the displayed error messages will appear in the text line. If the error persists for a prolonged period, the red LED lights and the fault indicator is activated (if connected).

In addition, depending on the type of the disturbance, the "spanner" or "telephone receiver" symbol on the display will light up.

- Spanner: Signifies a disturbance that can be remedied on site.
- Telephone receiver: Signifies a device disturbance. Contact the SMA Service Line.



Event no.	Message	Cause and corrective measures
101 - 103	Grid fault	<p>The line voltage has exceeded the permissible range. This error can have the following causes:</p> <ul style="list-style-type: none"> • The line voltage at the termination point of the inverter is too high. • The grid impedance at the termination point of the inverter is too high. <p>The inverter disconnects from the electricity grid for safety reasons.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Check the line voltage and grid connection on the inverter. If the line voltage is outside the permissible range due to local grid conditions, ask your network operator if the voltage can be adjusted at the feed-in point or if it would be acceptable to change the monitored operating limits. If the line voltage is within the tolerance range, yet this error is still displayed, contact the SMA Service Line.

Event no.	Message	Cause and corrective measures
202 - 205	Grid fault	<p>The line voltage has fallen below the permissible range. This error can have the following causes:</p> <ul style="list-style-type: none"> • Electricity grid disconnected • AC cable damaged • The line voltage at the termination point of the inverter is too low. <p>The inverter disconnects from the electricity grid for safety reasons.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Check whether the miniature circuit-breaker was triggered. • Check the line voltage and grid connection on the inverter. <p>If the line voltage is outside the permissible range due to local grid conditions, ask your network operator if the voltage can be adjusted at the feed-in point or if it would be acceptable to change the monitored operating limits.</p> <p>If the line voltage is within the tolerance range, yet this error is still displayed, contact the SMA Service Line.</p>
301	Grid fault	<p>The 10-minute average line voltage is no longer within the permissible range.</p> <p>This can be caused by one of the following:</p> <ul style="list-style-type: none"> • The line voltage at the termination point of the inverter is too high. • The grid impedance at the termination point of the inverter is too high. <p>The inverter disconnects from the electricity grid to assure compliance with the power quality.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Check the line voltage at the termination point of the inverter: <p>If, due to local grid conditions, the line voltage exceeds the configured limiting value, ask the network operator whether the voltage can be adjusted at the feed-in point, or whether it would be acceptable to modify the limiting value for power quality monitoring.</p> <p>If the line voltage is continually within the tolerance range, and this error is still displayed, contact the SMA Service Line.</p>

Event no.	Message	Cause and corrective measures
401 - 404	Grid fault	<p>The inverter is no longer in grid-parallel operation and has stopped feed-in operation for safety reasons.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> Check the grid connection for strong, short-term frequency variations. <p>If there are repeated frequent fluctuations and this error occurs as a result, ask your network operator if it would be acceptable to change the operating parameters.</p> <p>Discuss the proposed parameters with the SMA Service Line.</p>
501	Grid fault	<p>The power frequency is not within the permissible range. The inverter disconnects from the electricity grid for safety reasons.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> If possible, check the power frequency and observe how often major fluctuations occur. <p>If there are frequent fluctuations and this error occurs as a result, ask your network operator if it would be acceptable to change the operating parameters.</p> <p>Discuss the proposed parameters with the SMA Service Line.</p>
601	Grid fault	<p>The internal monitoring function of the inverter has detected an excessively high proportion of direct current in the line current. The inverter disconnects from the electricity grid.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> Check the grid connection for direct current. If this event occurs often, check with the network operator whether it is possible to raise the limiting value for monitoring.
701	Frq. not permitted	<p>The power frequency is outside the permissible range. The inverter disconnects from the electricity grid for safety reasons.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> If possible, check the power frequency and observe how often major fluctuations occur. <p>If there are frequent fluctuations and this error occurs as a result, ask your network operator if it would be acceptable to change the operating parameters.</p> <p>Discuss the proposed parameters with the SMA Service Line.</p>

Event no.	Message	Cause and corrective measures
801	Waiting for grid voltage	<p>There is no line voltage at the inverter's AC output.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Check the fuse and replace it if necessary. • Check AC installation. • Check whether there is a general power failure.
	Grid failure	
	Check fuse	
901	PE conn. missing	<p>The PE connection is missing. Half of the line voltage may be present on the unearthed enclosure. The inverter does not connect to the electricity grid.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Check AC installation. • Connect the PE cable to the AC terminal (see Section 6.3.2 "Connecting the Inverter to the Electricity Grid (AC)" (page 35)).
	Check connection	
1001	L / N swapped	<p>L and N are interchanged. The inverter does not connect to the electricity grid.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Correct the connection (see Section 6.3.2 "Connecting the Inverter to the Electricity Grid (AC)" (page 35)).
	Check connection	
1101	Installation fault	<p>A second line conductor is connected to N.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Correct the connection, (see Section 6.3.2 "Connecting the Inverter to the Electricity Grid (AC)" (page 35)).
	Check connection	
3301 - 3303	Unstable operation	<p>There is not enough power at the DC input of the inverter for stable operation. This may be caused by snow on the PV modules or insufficient sunlight. The inverter interrupts feed-in operation.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Wait for more irradiation. • If this event recurs at medium irradiation, check the PV plant design and ensure that the circuitry of the PV array is correct.

Event no.	Message	Cause and corrective measures
3401 - 3402	DC overvoltage	<p>The DC input voltage connected to the inverter is too high. The inverter interrupts the feed-in operation.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Immediately disconnect the inverter from the PV array (see Section 8.2 "Disconnecting the Inverter from Voltage Sources" (page 62)). The inverter may otherwise be destroyed. • Check the DC voltage of the strings for adherence to the maximum input voltage of the inverter before reconnecting the inverter to the PV array. • If the voltage is within the permissible input voltage range, the inverter may be defective. Contact the SMA Service Line.
	Disconnect generator	
3501	Insulation resist.	<p>The inverter has detected an earth fault in the PV array and does not connect to the electricity grid for safety reasons. The damaged insulation causes a risk of electric shock.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Check strings for earth faults (see Section 11.5 "Checking the PV Array for Earth Faults" (page 82)). • The installer (electrically skilled person) of the PV array must remedy the earth faults before you re-connect the affected string.
	Check generator	
3601	High leakage curr.	<p>The leakage current from the inverter and the PV array is too high.</p> <p>This can be caused by a sudden earth fault, a residual current or a malfunction.</p> <p>The inverter interrupts feed-in operation immediately after exceeding a limiting value and then automatically reconnects to the electricity grid once the fault has been remedied.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Check strings for earth faults (see Section 11.5 "Checking the PV Array for Earth Faults" (page 82)). • The installer (electrically skilled person) of the PV array must remedy the earth faults before you re-connect the affected string.
	Check generator	

Event no.	Message	Cause and corrective measures
3701	Resid.curr.too.high	<p>The inverter has detected residual current and interrupts the feed-in operation.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Check strings for earth faults (see Section 11.5 "Checking the PV Array for Earth Faults" (page 82)). • The installer (electrically skilled person) of the PV array must remedy the earth faults before you re-connect the affected string.
	Check generator	
3801 - 3802	DC overcurrent	<p>The inverter switches off due to an overcurrent on the DC side.</p> <p>Corrective measures:</p> <p>If this event occurs frequently:</p> <ul style="list-style-type: none"> • Check the design and the circuitry of the PV array.
	Check generator	
3901 - 3902	Waiting for DC start conditions	<p>The input power or the voltage of the PV modules is insufficient for feeding into the electricity grid.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Wait for more irradiation. • If this event recurs at medium irradiation, check the PV plant design and correct the circuitry of the PV array.
	Start cond. not met	
6001 - 6438	Self diagnosis	<p>Internal device fault. The inverter interrupts the feed-in operation.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Contact the SMA Service Line (see Section 15 "Contact" (page 99)).
	Interference device	
6501 - 6502	Self diagnosis	<p>The inverter interrupts the feed-in operation due to excessive internal temperature.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Ensure sufficient ventilation. • Check heat dissipation (see Section 9.2 "Checking Heat Dissipation" (page 67)).
	Overtemperature	
6603 - 6604	Self diagnosis	<p>The inverter has detected an internal overload and interrupts the feed-in operation.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Contact the SMA Service Line (see Section 15 "Contact" (page 99)).
	Overload	

Event no.	Message	Cause and corrective measures
6701 - 6702	Comm. disturbed	<p>A fault has occurred in the internal communication of the inverter. The inverter continues feeding into the electricity grid.</p> <p>Corrective measures:</p> <p>If this event occurs frequently:</p> <ul style="list-style-type: none"> • Contact the SMA Service Line (see Section 15 "Contact" (page 99)).
6801 - 6802	Self diagnosis	<p>Inverter input A is defective.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Contact the SMA Service Line (see Section 15 "Contact" (page 99)).
	Input A defective	
6901 - 6902	Self diagnosis	<p>Inverter input B is defective.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Contact the SMA Service Line (see Section 15 "Contact" (page 99)).
	Input B defective	
7001 - 7002	Sensor fault	<p>A temperature sensor in the inverter is faulty. The inverter interrupts the feed-in operation.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Contact the SMA Service Line (see Section 15 "Contact" (page 99)).
7008	Disturbance sensor display temperature	<p>The ambient temperature sensor is faulty. The display is not switched off at temperatures under -25°C and as a result may have been irreparably damaged. The inverter continues feeding into the electricity grid.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Contact the SMA Service Line (see Section 15 "Contact" (page 99)).
7101	SD card defective	<p>The SD card is not formatted correctly or is defective. The update failed. The inverter continues feeding into the electricity grid.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Re-format the SD card. • Re-save the files to the SD card.
7102	Parameter file not found or defective	<p>The parameter file was not found or is defective. The update failed. The inverter continues feeding into the electricity grid.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Copy the parameter file into the SD card drive:\PARASET directory.

Event no.	Message	Cause and corrective measures
7105	Param. setting failed	Operating parameters cannot be set via the SD card. The inverter continues feeding into the electricity grid. Corrective measures: <ul style="list-style-type: none"> Check the operating parameters for valid values. Ensure change rights via SMA Grid Guard code.
7106	Update file defect.	The update file is defective. The update failed. The inverter continues feeding into the electricity grid. Corrective measures: <ul style="list-style-type: none"> Re-format the SD card. Re-save the files to the SD card.
7110	No update file found	No new update file was found on the SD card. The update failed. The inverter continues feeding into the electricity grid. Corrective measures: <ul style="list-style-type: none"> Copy the update file into the SD card drive : \UPDATE directory.
7201 - 7202	Data stor. not poss.	Internal device fault, the inverter continues feeding into the electricity grid. Corrective measures: <ul style="list-style-type: none"> If this fault occurs often, contact the SMA Service Line (see Section 15 "Contact" (page 99)).
7303	Update main CPU failed	Internal device fault. The inverter continues feeding into the electricity grid. In very rare cases, the firmware is damaged and the inverter interrupts feed-in. Corrective measures: <ul style="list-style-type: none"> Contact the SMA Service Line (see Section 15 "Contact" (page 99)).
7305	Update RS485I module failed	Internal device fault, the inverter continues feeding into the electricity grid. Corrective measures: <ul style="list-style-type: none"> Re-try update. If this fault occurs again, contact the SMA Service Line (see Section 15 "Contact" (page 99)).
7307	Update Bluetooth failed	
7311	Update language table failed	
7401	Varistor defective	At least one of the thermally monitored varistors is defective. The inverter is no longer protected against overvoltage. The inverter continues feeding into the electricity grid. Corrective measures: <ul style="list-style-type: none"> Check the varistors (see Section 11.6 "Checking the Function of the Varistors" (page 84)).

Event no.	Message	Cause and corrective measures
7508	External fan fault	<p>The fan is contaminated or defective. The inverter may reduce its power output due to overheating. The inverter continues feeding into the electricity grid.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> Clean the fans. Replace the fans.
	Replace fan	
7701 - 7703	Self diagnosis	<p>Internal device fault. The inverter disconnects from the electricity grid.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> Contact the SMA Service Line (see Section 15 "Contact" (page 99)).
	Interference device	
8001	Derating occurred	<p>The power supplied by the inverter has fallen below the nominal power due to excessive temperature for more than 10 minutes.</p> <p>Corrective measures:</p> <p>If this event occurs frequently:</p> <ul style="list-style-type: none"> Ensure sufficient ventilation. Check heat dissipation (see Section 9.2 "Checking Heat Dissipation" (page 67)).
8101 - 8104	Comm. disturbed	<p>A fault has occurred in the internal communication of the inverter. The inverter continues feeding into the electricity grid.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> Contact the SMA Service Line (see Section 15 "Contact" (page 99)).
8801 - 8803	No display	<p>The display is blank. The inverter continues feeding into the electricity grid. This error can have the following causes:</p> <ul style="list-style-type: none"> The ambient temperature is so low that the display disconnects to protect. The inverter cannot identify the display type. No display is connected or the connection is defective. <p>Corrective measures:</p> <ul style="list-style-type: none"> Wait until the temperature has risen above -25°C. Contact the SMA Service Line (see Section 15 "Contact" (page 99)).
9002	Inst. code invalid	<p>The SMA Grid Guard code entered (personal installer password) is not valid.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> Enter a valid SMA Grid Guard code.

Event no.	Message	Cause and corrective measures
9003	Grid param. locked	<p>The current country data set is locked.</p> <p>Corrective measures:</p> <ul style="list-style-type: none"> • Enter a valid SMA Grid Guard code for changing the country data set.
9005	Changing grid param. not possible	<p>This error can have the following causes:</p> <ul style="list-style-type: none"> • The selected rotary switch setting for the language settings is not programmed. • The parameters to be changed are protected. • DC voltage at the DC input is not sufficient to run the main CPU. <p>Corrective measures:</p> <ul style="list-style-type: none"> • Check the rotary switch setting (see Section 6.5.1 "Checking the Country Standard" (page 48)). • Enter the SMA Grid Guard code. • Ensure sufficient DC voltage is available (green LED is glowing or flashing).
	Ensure DC supply	

11.4 DC Current after AC-side Disconnection

In spite of the AC side having been disconnected, a current is still detectable in the DC cables with a current clamp. This is not an error but normal behaviour of the inverter when in operation.

- Always disconnect the inverter on the AC **and** DC sides (see Section 8.2 "Disconnecting the Inverter from Voltage Sources" (page 62)).

11.5 Checking the PV Array for Earth Faults

If the red LED is glowing and the inverter displays event number "3501", "3601" or "3701", then there is probably an earth fault in the PV array.

Check the strings for earth faults as described below:

1. Disconnect the inverter and open it (see Section 8.2 "Disconnecting the Inverter from Voltage Sources" (page 62)).

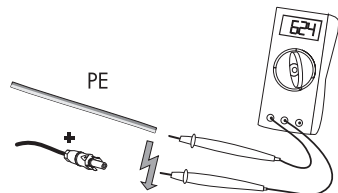


Notice!

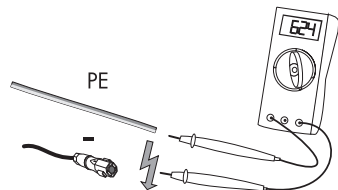
Excessive voltages can destroy the measuring device

- Only use measuring devices with a DC input voltage range up to at least 1 000 V.

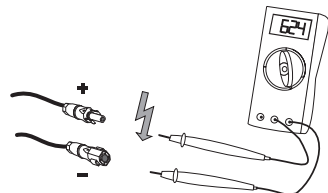
2. Measure the voltages between the positive terminal of each string and the earth potential (PE).



3. Measure the voltages between the negative terminal of each string and the earth potential (PE).



4. Measure the voltages between the positive and negative terminals of each string.



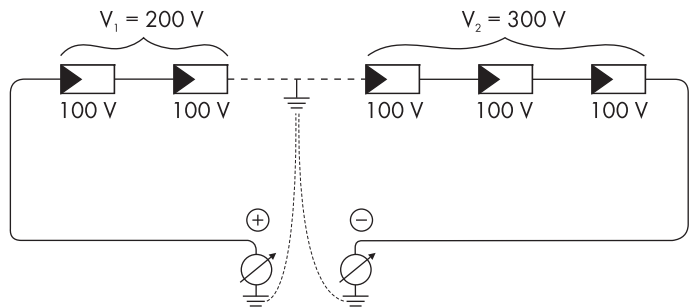
- ☑ An earth fault exists if the measured voltages are stable and the sum of the voltages from the positive terminal to the earth potential and from the negative terminal to the earth potential of a string is approximately equal to the voltage between the positive and negative terminals.

Result	Measure
☑ You have found an earth fault.	<ul style="list-style-type: none">The installer (electrically skilled person) of the PV array must remedy the earth fault in the affected string before you reconnect the string to the inverter. The illustration below shows how to determine the location of the earth fault.Do not reconnect the faulty string.Commission the inverter again (see Section 7.1 "Commissioning the Inverter" (page 54)).
☑ You have not found an earth fault.	<p>One of the thermally monitored varistors is probably defective.</p> <ul style="list-style-type: none">Check the function of the varistors (see Section 11.6 "Checking the Function of the Varistors" (page 84)).

Location of the earth fault

The approximate position of the earth fault can be determined from the ratio of the measured voltages between the positive terminal against earth potential (PE) and the negative terminal against earth potential (PE).

Example:



In this case, the earth fault is between the second and third PV module.

- ☑ The earth fault check is now complete.

11.6 Checking the Function of the Varistors

If the inverter displays the event number "7401", then one of the varistors is probably defective. Varistors are wear parts. Their functional efficiency diminishes with age or following repeated responses as a result of overvoltages. It is therefore possible that one of the thermally monitored varistors has lost its protective function.



NOTICE!

Destruction of the inverter due to overvoltage

If varistors are missing or defective, the inverter is no longer protected against overvoltages.

- Do not operate the inverter without varistors in PV plants with a high risk of overvoltages.
- Functional replacement varistors should be obtained as soon as possible.

Check the varistors as described below:

1. Disconnect the inverter and open it (see Section 8.2 "Disconnecting the Inverter from Voltage Sources" (page 62)).



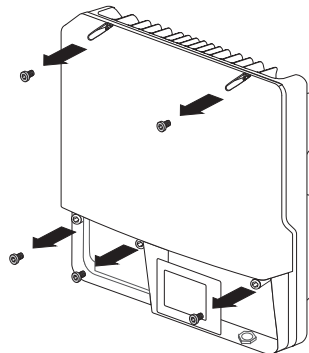
DANGER!

Danger to life due to high voltages in the inverter

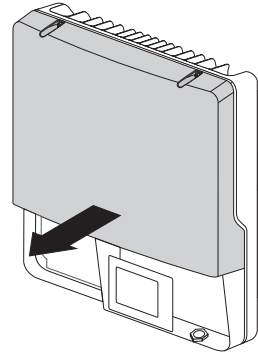
The capacitors in the inverter may be charged with very high voltages.

- Wait 5 minutes before opening the enclosure lid, in order to allow time for the capacitors to discharge.

2. Undo the screws of the upper enclosure lid. Use an Allen key (width across flats 4) for this.



3. Pull the upper enclosure lid forwards to remove it.



NOTICE!

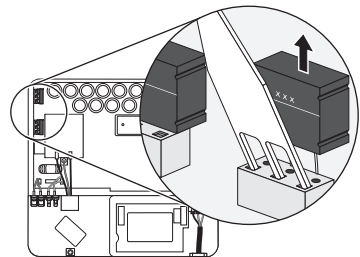
Electrostatic discharge can damage the inverter

Components on the inside of the inverter may be irreparably damaged due to electrostatic discharge.

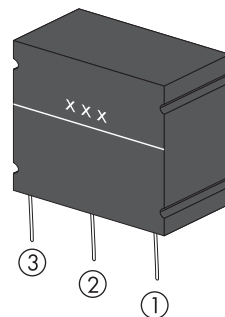
- Earth yourself before touching any components.

4. Remove all varistors.

If you do not receive an insertion tool for operating the terminals with your replacement varistors, contact SMA Solar Technology AG.

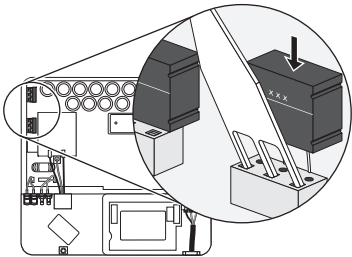


5. Use a multimeter to check each varistor for a conductive connection between terminals 2 and 3.



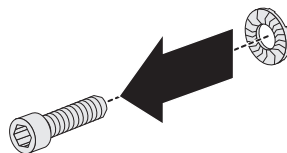
Result	Measure
<input checked="" type="checkbox"/> There is a conductive connection.	<p>The varistor is functional. There is a different error in the inverter.</p> <ul style="list-style-type: none">• Contact the SMA Service Line (see Section 15 "Contact" (page 99)).
<input checked="" type="checkbox"/> There is no conductive connection.	<p>The respective varistor is defective and must be replaced.</p> <p>Varistor failure is generally due to influences that affect all varistors in a similar manner (temperature, age, induced overvoltage). SMA Solar Technology AG recommends replacing all varistors.</p> <p>The varistors are specially manufactured for use in the inverter and are not commercially available. You must order replacement varistors directly from SMA Solar Technology AG (see Section 14 "Accessories" (page 98)). Only use original varistors that are sold by SMA Solar Technology AG.</p> <ul style="list-style-type: none">• For the replacement of the varistors, proceed to step 6.

6. Insert an insertion tool into the openings of the terminal contacts.
7. Insert new varistors into the slots (as shown in the drawing at right).
- Here, the labelling must point to the left, i.e. towards the insertion tool.

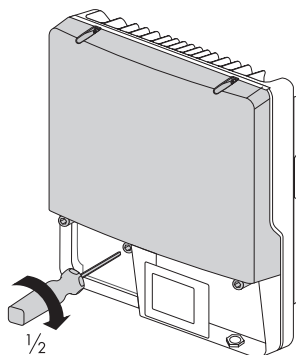


8. Close and earth the inverter:

- Attach one conical spring washer on each screw. Here, the grooved side of the conical spring washer must point to the screw head.

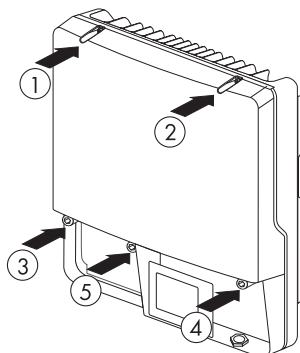


- Attach the upper enclosure lid to the enclosure and tighten the centre lower screw halfway. Use an Allen key (width across flats 4) for this.



- Secure the upper enclosure lid in the sequence 1 to 5 (torque: 6 Nm). Use an Allen key (width across flats 4) for this.

- ☒ The teeth of the conical spring washer are pushed into the upper enclosure lid. This earths the upper enclosure lid.



9. Close the lower enclosure lid and commission the inverter again (see Section 8.3 "Closing the Inverter" (page 65)).

12 Decommissioning

12.1 Disassembling the Inverter

1. Disconnect the inverter and open it (see Section 8.2 "Disconnecting the Inverter from Voltage Sources" (page 62)).
2. Remove all communication cables from the inverter.

**CAUTION!****Risk of burns due to hot enclosure parts**

- Wait 30 minutes for the enclosure to cool down before disassembling.

3. If necessary, remove the padlock.
4. Remove the inverter by lifting it upwards off the wall mounting bracket.

12.2 Replacing the Enclosure Lid

In the event of a fault, your inverter may need to be replaced. If this is the case, you will receive a replacement device fitted with an upper and lower transport lid.

Prior to returning your inverter to SMA Solar Technology AG, you must replace the upper and lower enclosure lids of your inverter with the corresponding transport lids:

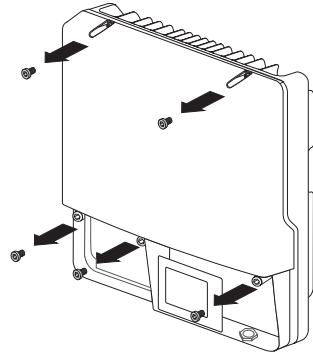
1. Disassemble the inverter (see Section 12.1 "Disassembling the Inverter" (page 88)).

**DANGER!****Danger to life due to high voltages in the inverter**

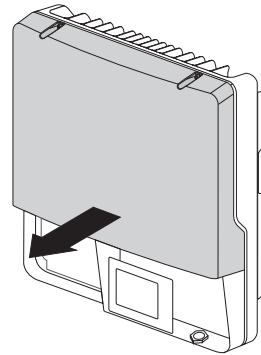
The capacitors in the inverter may be charged with very high voltages.

- Wait 5 minutes before opening the enclosure cover, in order to allow time for the capacitors to discharge.

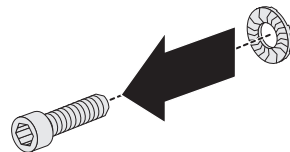
2. Undo the screws of the upper enclosure lid. Use an Allen key (width across flats 4) for this.



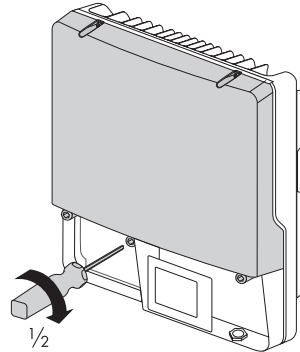
3. Pull the upper enclosure lid forwards to remove it.



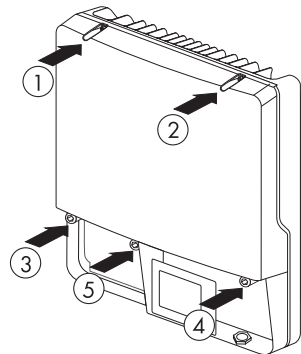
4. Remove the two transport lids from the replacement device in the same manner.
5. Close and earth the replacement device:
 - Attach one conical spring washer on each screw. Here, the grooved side of the conical spring washer must point to the screw head.



- Attach the upper enclosure lid to the enclosure and tighten the centre lower screw halfway. Use an Allen key (width across flats 4) for this.



- Secure the upper enclosure lid in the sequence 1 to 5 (torque: 6 Nm). Use an Allen key (width across flats 4) for this.
- ☑ The teeth of the conical spring washer are pushed into the upper enclosure lid. This earths the upper enclosure lid.



6. Mount the replacement device (see Section 5 "Mounting" (page 25)).
 7. Connect the replacement device (see Section 6 "Electrical Connection" (page 30)).
 8. Commission the replacement device (see Section 7 "Commissioning" (page 54)).
 9. Now mount the two transport lids of the replacement device onto the defective inverter.
- ☑ You can now send the defective inverter back to SMA Solar Technology AG.

12.3 Packing the Inverter

- If available, use the original packaging of the inverter.
- If the original packaging is not available, use a cardboard box suitable for the weight and size of the inverter.

12.4 Storing the Inverter

Store the inverter in a dry place where ambient temperatures are always between -25°C and $+60^{\circ}\text{C}$.

12.5 Disposing of the Inverter

Dispose of the inverter at the end of its service life in accordance with the disposal regulations for electronic waste which apply at the installation location at that time. Alternatively, send it back to SMA Solar Technology AG with shipping paid by sender, and labelled "ZUR ENTSORGUNG" ("for disposal") (for contact, see Page 99).

13 Technical Data

13.1 DC/AC

13.1.1 Sunny Boy 2500TL Single Tracker

DC Input

Maximum DC power at $\cos \varphi = 1$	2 650 W
Maximum input voltage*	750 V
MPP voltage range	180 V ... 500 V
Rated input voltage	400 V
Minimum input voltage	125 V
Start input voltage	150 V
Maximum input current	15 A
Maximum input current per string	15 A
Number of independent MPP inputs	1
Strings per MPP input	2

* The maximum open-circuit voltage that can occur with -10°C cell temperature must not exceed the maximum input voltage.

AC Output

Rated power at 230 V, 50 Hz	2 500 W
Maximum apparent AC power	2 500 VA
Rated grid voltage	230 V
AC nominal voltage	220 V / 230 V / 240 V
AC voltage range*	180 V ... 280 V
Nominal AC current at 220 V	11.4 A
Nominal AC current at 230 V	10.9 A
Nominal AC current at 240 V	10.4 A
Maximum output current	12.4 A
Total harmonic factor of the output current at AC total harmonic factor < 2%, AC power > 0.5 nominal AC power	$\leq 4\%$
Rated power frequency	50 Hz
AC power frequency*	50 Hz / 60 Hz
Operating range at AC power frequency 50 Hz	45 Hz ... 55 Hz
Operating range at AC power frequency 60 Hz	55 Hz ... 65 Hz
Displacement power factor, adjustable	0.8 _{overexcited} ... 0.8 _{underexcited}
Feed-in phases	1

Connection phases	1
Overvoltage category as per IEC 60664-1	III

* Depending on country setting

Efficiency

Maximum efficiency, η_{\max}	97.0%
European weighted efficiency, η_{EU}	95.8%

13.1.2 Sunny Boy 3000TL Single Tracker

DC Input

Maximum DC power at $\cos \varphi = 1$	3 200 W
Maximum input voltage*	750 V
MPP voltage range	213 V ... 500 V
Rated input voltage	400 V
Minimum input voltage	125 V
Start input voltage	150 V
Maximum input current	15 A
Maximum input current per string	15 A
Number of independent MPP inputs	1
Strings per MPP input	2

* The maximum open-circuit voltage that can occur with -10°C cell temperature must not exceed the maximum input voltage.

AC Output

Rated power at 230 V, 50 Hz	3 000 W
Maximum apparent AC power	3 000 VA
Rated grid voltage	230 V
AC nominal voltage	220 V / 230 V / 240 V
AC voltage range*	180 V ... 280 V
Nominal AC current at 220 V	13.6 A
Nominal AC current at 230 V	13.1 A
Nominal AC current at 240 V	12.5 A
Maximum output current	14.6 A
Total harmonic factor of the output current at AC total harmonic factor < 2%, AC power > 0.5 nominal AC power	$\leq 4\%$
Rated power frequency	50 Hz
AC power frequency*	50 Hz / 60 Hz

Operating range at AC power frequency 50 Hz	45 Hz ... 55 Hz
Operating range at AC power frequency 60 Hz	55 Hz ... 65 Hz
Displacement power factor, adjustable	0.8 _{overexcited} ... 0.8 _{underexcited}
Feed-in phases	1
Connection phases	1
Overvoltage category as per IEC 60664-1	III

* Depending on country setting

Efficiency

Maximum efficiency, η_{\max}	97.0%
European weighted efficiency, η_{EU}	96.1%

13.2 General Data

Width x height x depth, without Electronic Solar Switch	490 mm x 488 mm x 185 mm
Width x height x depth, with Electronic Solar Switch	490 mm x 519 mm x 185 mm
Weight	23 kg
Length x width x height of packaging	597 mm x 617 mm x 266 mm
Transport weight	26 kg
Climatic category as per IEC 60721-2-1	4K4H
Operating temperature range	- 25°C ... +60°C
Maximum permissible value for relative humidity, non-condensing	100%
Maximum operating altitude above Mean Sea Level	2 000 m
Noise emission (typical)	≤ 25 dB(A)
Power loss in night operation	< 1 W
Topology	Transformerless
Cooling concept	Convection
Degree of protection for electronics according to IEC 60529	IP65
Connection area degree of protection according to IEC 60529	IP54
Protection class (according to IEC 62103)	I

13.3 Protective Devices

DC reverse-polarity protection	Short-circuit diode
Input-side load disconnect unit*	Electronic Solar Switch
DC overvoltage protection	Thermally monitored varistors
AC short-circuit current capability	Current control
Grid monitoring	SMA Grid Guard 3
Maximum permissible fuse protection	25 A
Earth-fault monitoring	Insulation monitoring: $R_{iso} > 625 \text{ k } \Omega$
All-pole-sensitive residual-current monitoring unit	Available

*optional

13.4 Approvals

National standard, status 03/12*	SB 2500TLST-21	SB 3000TLST-21
VDE 0126-1-1	✓	✓
C10/C11	✓	✓
PPDS	○	○
UTE C15-712-1	○	○
PPC	○	○
EN 50438	○	○
RD 1699	○	○
RD 661/2007	○	○
G83/1-1	✓	✓
G59/2	✓	✓
VDE-AR-N 4105	✓	✓

○ In planning stage

* C10/11 (05/2009): Only possible when the phase voltage is 230 V.

EN 50438: Does not apply to all country standard deviations of EN 50438.

RD 1669 and RD 661/2007: Contact the SMA Service Line for restrictions in specific regions.

13.5 Climatic Conditions

According to IEC 60721-3-4, installation type C, class 4K4H

Extended temperature range	– 25°C ... +60°C
Extended humidity range	0% ... 100%
Extended air pressure range	79.5 kPa ... 106 kPa

According to IEC 60721-3-2, transport type E, class 2K3

Temperature range	– 25°C ... +70°C
-------------------	------------------

13.6 Features

DC connection	SUNCLIX DC connector
AC connection	Spring clamp terminal
Display	LC graphic display
Bluetooth	As standard
RS485, galvanically isolated	Optional
Multi-function relay	Optional
Electronic Solar Switch	Optional

13.7 Electronic Solar Switch

Electrical endurance in the event of a short circuit, with a nominal current of 35 A	at least 50 switching processes
Maximum switching current	35 A
Maximum switching voltage	800 V
Maximum PV power	12 kW
Degree of protection when plugged	IP65
Degree of protection when unplugged	IP21

13.8 Torques

Upper enclosure lid screws	6.0 Nm
Lower enclosure lid screws	2.0 Nm
Additional earth terminal	6.0 Nm
SUNCLIX swivel nut	2.0 Nm
RS485 interface fastening screw	1.5 Nm
Multi-function relay fastening screw	1.5 Nm

13.9 Earthing Systems

TN-C	Suitable
TN-S	Suitable
TN-C-S	Suitable
TT, if $U_{N-PE} < 1.5\text{ V}$	Suitable

13.10 Data Storage Capacity

Daily energy yield performance	63 days
Daily yields	30 years
Event messages for users	250 events
Event messages for installers	250 events

14 Accessories

You will find the corresponding accessories and spare parts for your product in the following overview. If required, you can order them at SMA Solar Technology AG or your specialised dealer.

Designation	Brief description	SMA order number
Replacement varistors	Set of thermally monitored varistors	MSWR-TV9
Electronic Solar Switch	ESS handle spare part	Order the new ESS handle via the SMA Service Line (see Section 15 "Contact" (page 99)).
Multi-function relay	Multi-function relay for retrofitting in PV inverters	MFR01-10
RS485 retrofit kit	RS485 interface	DM-485CB-10
SUNCLIX DC connector	Field plug for conductor cross-sections of 2.5 mm ² ... 6 mm ²	SUNCLIX-FC6-SET
Additional fan kit	Fan for installation in the inverter	FANKIT01-10

15 Contact

If you have technical problems concerning our products, please contact the SMA Service Line. We require the following information in order to provide you with the necessary assistance:

- Inverter device type
- Inverter serial number
- Type and number of the PV modules connected
- 4-digit event number and display message of the inverter
- Optional equipment, e.g. communication products
- Confirmation of whether or not a multi-function relay is used
- Mounting location

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